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US EPA RECORDS CENTER REGION 5
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DRIFT-PLATTEVILLE AQUIFER
GRADIENT CONTROL WELL PLAN

CONTENTS

SECTION A

SITE MANAGEMENT PLAN

Gradient Control Well Location

Section 9.2.1 of the Remedial Action Plan specifies that the Drift gradient control well must be located within 500 feet downgradient of existing monitoring well W12. The purpose of the Drift gradient control well is to prevent contaminated ground water from entering the nearby bedrock valley and contaminating other aquifers. Figure 1 shows the location of W12, the bedrock valley, and the proposed Drift gradient control well. The proposed location is approximately 500 feet from W12, and should be suitable for protecting the bedrock valley from contamination. The proposed location lies within a city-owned right of way.

Well Design, Drilling Plans and Procedures

The design, drilling plans and procedures for construction of the Drift gradient control well will accommodate a 4-inch submersible pump capable of yielding 50 gallons per minute, as specified in the RAP. The Drift gradient control well is designed to intercept water over the full thickness of the Middle Drift Aquifer (Figure 2). Prior to drilling this well, a boring will be performed in the immediate vicinity in order to locate the Middle Drift Aquifer. This will ensure that the well will not interconnect isolated water bearing zones within the Drift Aquifer. Design considerations are as follows:

- The well will be drilled using direct rotary drilling techniques to the depth of the top of the bedrock (approximately 65 feet). A nominal 10-inch hole will be drilled to allow for proper grout seal of the well casing. A minimum bit size of 10 inches will be used to comply with the MDH well code requirement of 4 inches between casing and borehole diameters.

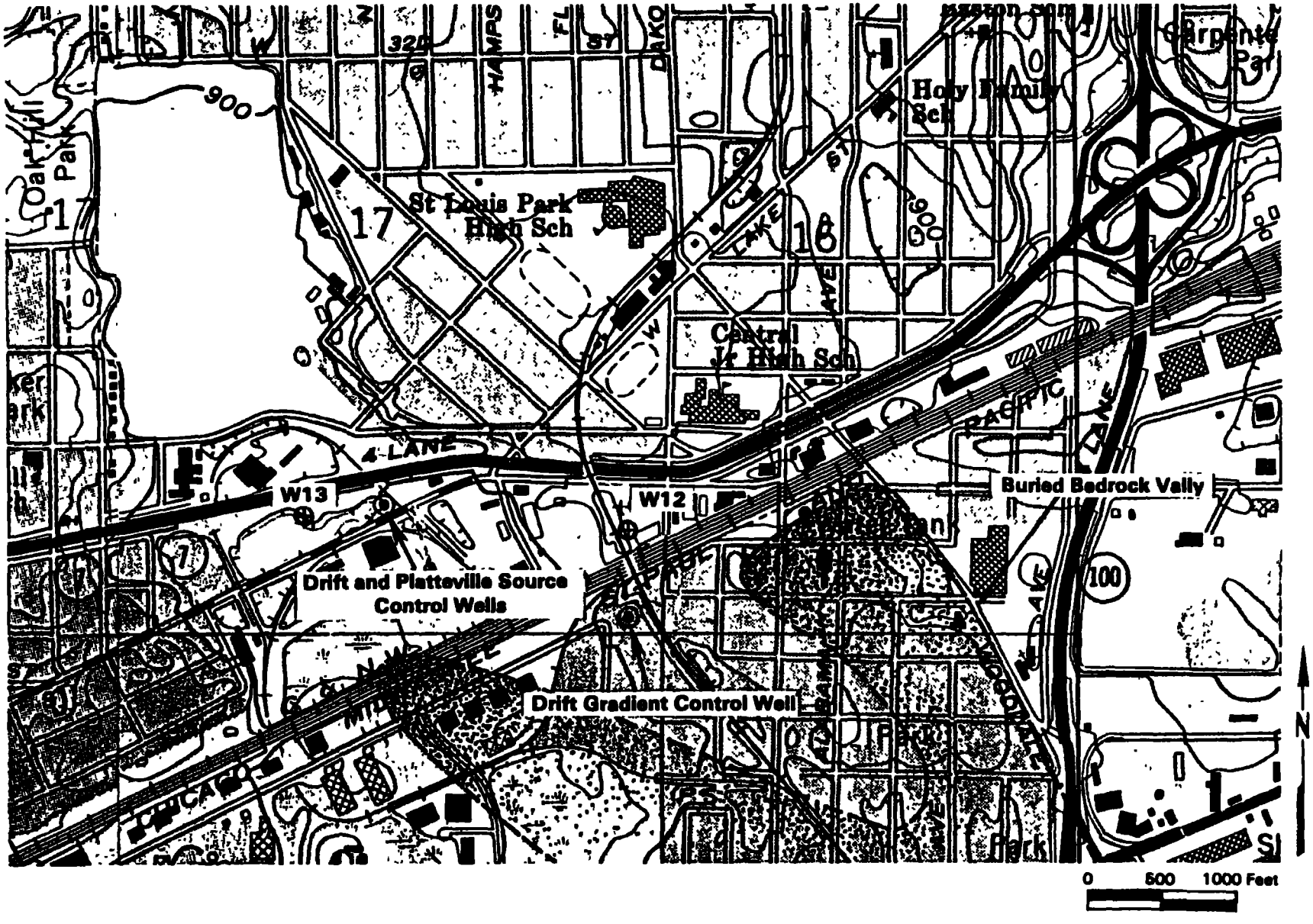
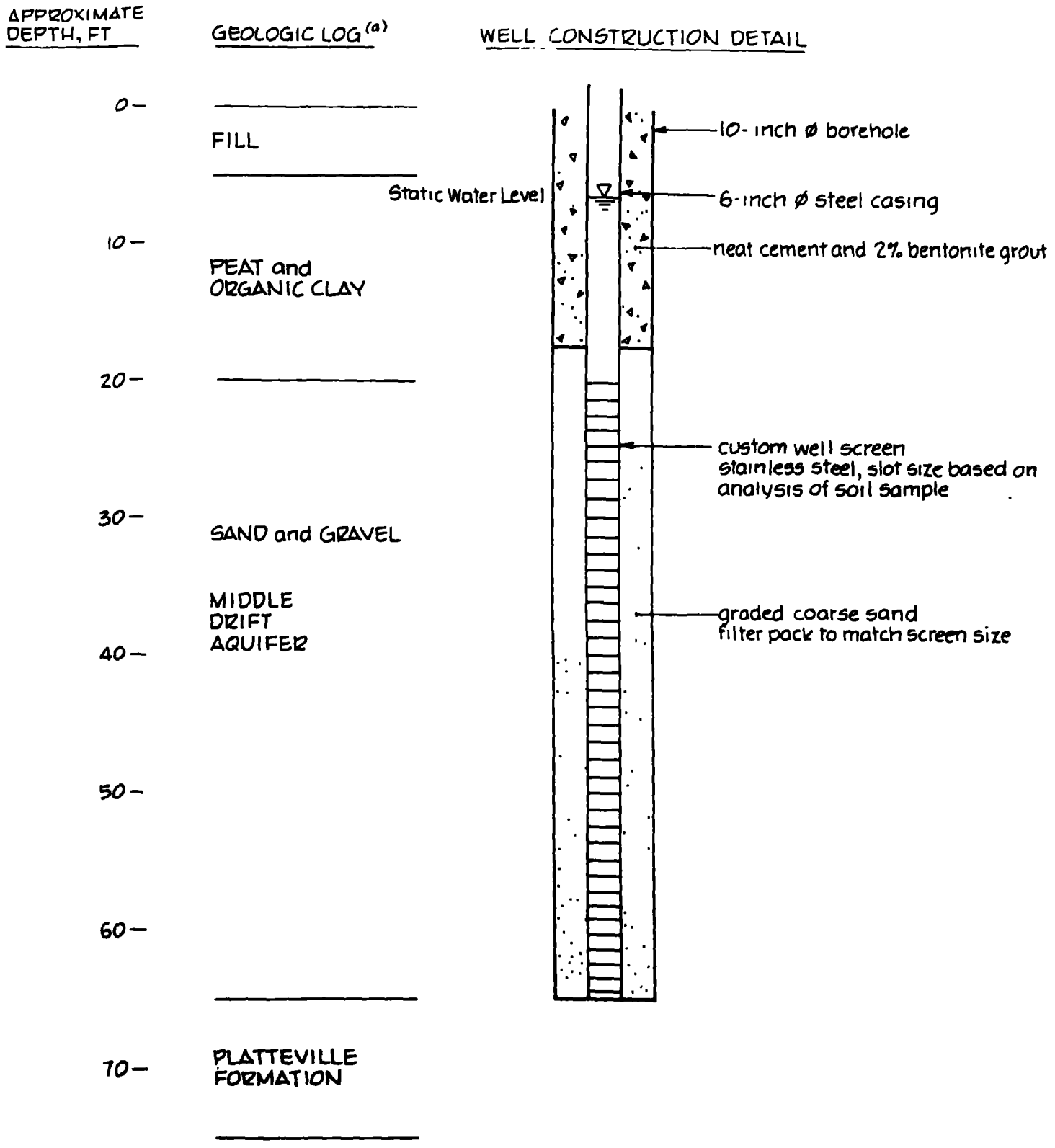


Figure 1 Proposed Locations of Drift and Platteville Control Wells



(a) Based on the log for boring B-11 by Barr, 1976.

Figure 2 Drift Aquifer Gradient Control Well Design

- Continuous split-spoon samples will be collected in order to define the stratigraphy at this location and to provide samples for mechanical grain size analysis.
- The well will be screened in the thickest sand and gravel layer in the Middle Drift Aquifer. The well screen will be constructed of stainless steel. The determination of the screened interval will be subject to review by EPA and MPCA Project Leaders in accordance with Part O of the Consent Decree and Section 9.2 of the RAP.
- The well screen slot size will be based on a mechanical sieve analysis of soil samples retrieved from the area in which the screen will be placed. A slot size which will hold out 40 to 60 percent of the material will be used. Additionally, the screen intake velocity will be less than 0.1 foot per second.
- The steel well casing will extend from the top of the well screen to the ground surface (leaving an appropriate stickup for a well head). The well casing will be pressure grouted using a 2% bentonite neat cement grout mix.
- Upon completion of the well, a gravel pack will be developed around the well screen by a high velocity jetting and pumping technique.
- Upon completion of the well a reference point for measuring water levels will be established at the well head. The horizontal location and vertical elevation of this reference point will be surveyed.

A licensed well driller will be contracted to install the gradient control well. The licensed well contractor will use direct rotary techniques to advance the borehole. Casings will be grouted into place with a tremie pipe. All grout and other material specifications will conform with the requirements of the Minnesota Water Well Construction Code. The drilling site will be kept neat and clean at all times. Drilling fluids,

cuttings, and other debris will be handled in accordance with the Contingency Plan (Appendix D). Drilling tools and equipment will be steam cleaned before and after drilling. A record containing documentation of these procedures, field notes, well logs, measurements, etc., will be maintained.

The adjacent St. Peter Aquifer monitoring well that will be installed by the City of St. Louis Park will not pose a problem for the installation of the Drift gradient control well, and vice versa. Industry standard alignment techniques preclude any physical damage to either well due to the drilling of the other. Also, the St. Peter Aquifer monitoring well will be drilled using cable tool techniques through the drift, therefore no drilling fluid or grout will be used in that installation. If the St. Peter Aquifer monitoring well design is changed, and mud rotary methods are used to drill through the drift, migration of drilling fluid or grout into the surrounding drift materials will only penetrate approximately one foot. Since the two wells will be about seven feet apart there will be no detrimental influence on well construction regardless of the order in which the wells are installed.

Pump Specifications and Installation

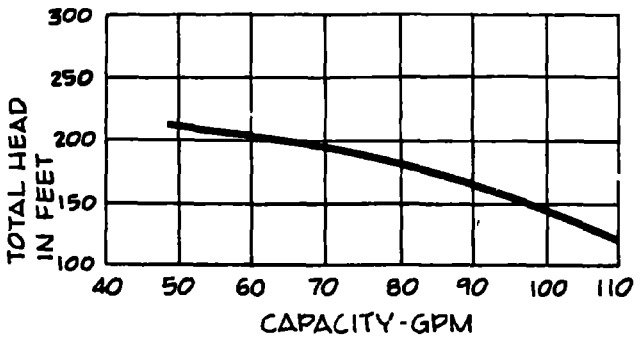
The monthly average pumping rate specified in the RAP for the Drift gradient control well is 50 gallons per minute. The total head lift that the submersible pump will be required to overcome is estimated to be 140 feet (Appendix A). A 4-inch diameter, 3-phase, 5 hp submersible pump will be required to achieve the required pumping rate and total head lift. A Grundfos Model SP16-5 pump or equivalent will be used in the gradient control well. The specifications and rating curve for this pump are shown in Figure 3. The construction materials for the submersible pump and discharge pipe will be as follows:

- The submersible pump will be constructed of stainless steel;

U122

SP 16-5

PERFORMANCE CURVE



DIMENSIONS AND WEIGHT

MODEL NO.	HP	MIN. WELL SIZE	LENGTH	APPROX. UNIT SHIPPING WT. (LBS.)
SP16-5	5	6"	44 3/8"	87

NOMINAL FLOW RATE - 80 GPM
FLOW RANGE - 48 to 110 GPM
PUMP OUTLET - 3" NPT

Figure 3 Pump Specifications for Drift Gradient Control Well

- A 2-inch national pipe thread (NPT) discharge pipe will extend from the pump outlet to the point of discharge. The discharge pipe will be constructed of galvanized steel.

The submersible pump will be installed safely below the pumping water level, as determined by the aquifer test. The pump will be installed above the well screen, if possible, to prvent cavitation or encrustation of the well screen adjacent to the pump intake. The use of low carbon steel and stainless steel components will increase the operational life expectancy of the system.

Aquifer Testing Plan

The RAP requires that an aquifer test be conducted at the Drift gradient control well. The gradient control well pump test will be performed in accordance with ERT Standard Operating Procedure Number 7730, Aquifer Test and Data Evaluation (Appendix B) with the modifications specified in this work plan. Where there are differences between the procedures described in Appendix B and this Site Management Plan, the Site Management Plan will have priority. The parameters that will be ascertained during the aquifer test include the local Middle Drift Aquifer hydraulic conductivity, and storativity. The Drift gradient control well pump test will be performed after the Drift and Platteville source control well pump tests.

Figure 4 shows the proposed location of the Drift gradient control well and the locations of potential observation wells screened in the Drift aquifer. Drawdowns during the aquifer test can be estimated using analysis developed by Neuman (1975). The analysis incorporates the following assumptions:

Neuman, S.P. 1975. Analysis of Pump Test Data from Anisotropic Unconfined Aquifers Considering Delayed Gravity Response. Water Resources Research. Vol. 11, No. 2.

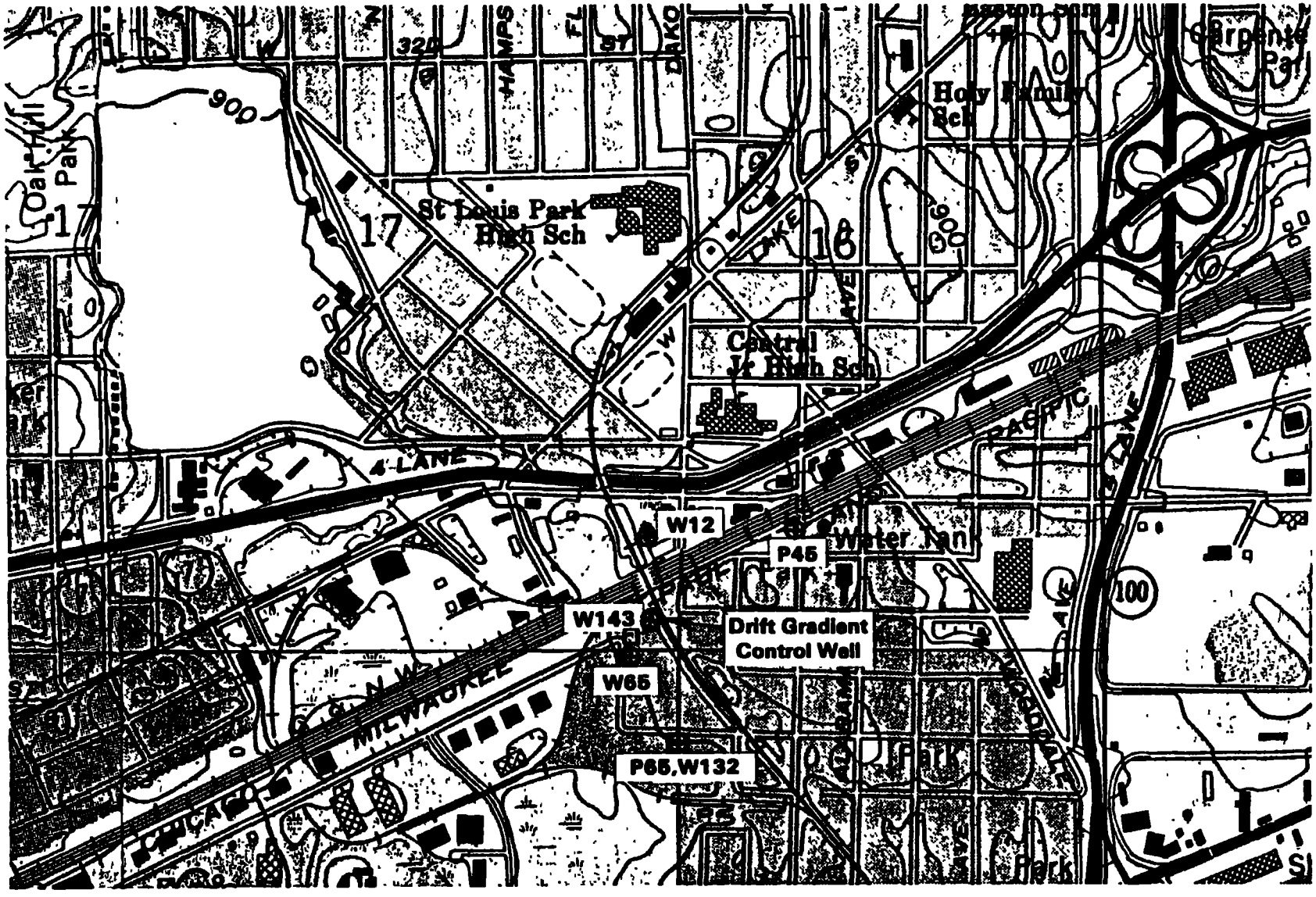


Figure 4 Locations of Potential Monitoring Wells Near Drift Gradient Control Well

- fully penetrating wells with no storage capacity;
- uniformly porous unconfined aquifer underlain by an aquiclude;
- homogeneous, anisotropic aquifer of infinite extent and constant thickness; and
- drawdown negligible with respect to saturated thickness.

Based on a horizontal hydraulic conductivity of 1030 gpd/ft^2, aquifer thickness of 65 feet, storage coefficient of 0.0001, specific yield of 0.1, ratio of vertical to horizontal conductivity of 0.1, and pumping rate of 200 gpm, at least one foot of drawdown is expected at wells within 300 feet of the pumping well. (Hydraulic conductivity is estimated based on previous aquifer tests in the area, while other parameters are based on typical literature values for glacial drift). Measurable drawdowns are expected in the Drift aquifer within 1000 feet of the pumping well. There are several potential monitoring wells within 1000 feet of the proposed Drift gradient control well: W65 at 310 feet, W12 at 620 feet, P65 at 890 feet, and P45 at 1300 feet. In addition, the reaction of the Platteville aquifer to pumping in the Drift aquifer will be monitored if suitable Platteville observation wells are available (e.g., W132, W143).

Prior to the aquifer test the potential observation wells must be located and examined. The integrity of the wells will be checked to ensure that they have not been permanently sealed, damaged, or destroyed. In addition, a brief slug test will be performed at each potential observation well to demonstrate the well's response to hydraulic stress. One well volume will be removed from each potential observation well. Wells that do not recover to ninety percent of their original water level within 5 minutes will be eliminated as potential observation wells. A minimum of two observation wells will be used in the Drift Aquifer as specified by the Remedial Action Plan. At least one of the observation wells will be W12, W65,

or other potentially available monitoring wells in the area (e.g., wells at the Taracorp Site) within about 600 feet of the pumping well. At least one other observation well will be P45, P65, or other potentially available wells within about 1000 feet of the pumping well. If, following inspection, there are fewer than two satisfactory observation wells in the Drift Aquifer, it will be necessary to construct additional wells to bring the total number of monitoring wells to two. Prior to the performance of the Drift gradient control pump test, the results of the Drift source control pump test will be analyzed to determine if additional monitoring wells are required in the vicinity of the Drift gradient control well. If additional observation wells are required, their construction will be consistent with the conceptual design presented in Figure 5. The selection of observation wells (and installation of additional observation wells -- if required) will be subject to review by the EPA and MPCA Project Leaders in accordance with Part O of the Consent Decree and consistent with Section 9.2.1 of the RAP.

In addition, water level measurements will be collected at a distant well (beyond the pumping well cone of influence) in order to identify extraneous influences. The use of a distant well will allow correction of observed drawdowns in the event of precipitation during the aquifer test. If possible the aquifer test will be conducted during a non-rain event. Throughout the aquifer test atmospheric pressure will be recorded so that water levels can be adjusted for changes due to barometric trends.

An In-Situ SE-200 Hydrologic Analysis System or equivalent will be used in conjunction with pressure transducers to log water level data at the pumping well and at the observation wells. Use of a computerized data logging system will allow accurate collection of early-time measurements during both the pumping and the recovery phases of the aquifer test.

During the Drift aquifer test, the Drift gradient control well will be pumped at the rate of 200 gallons per minute

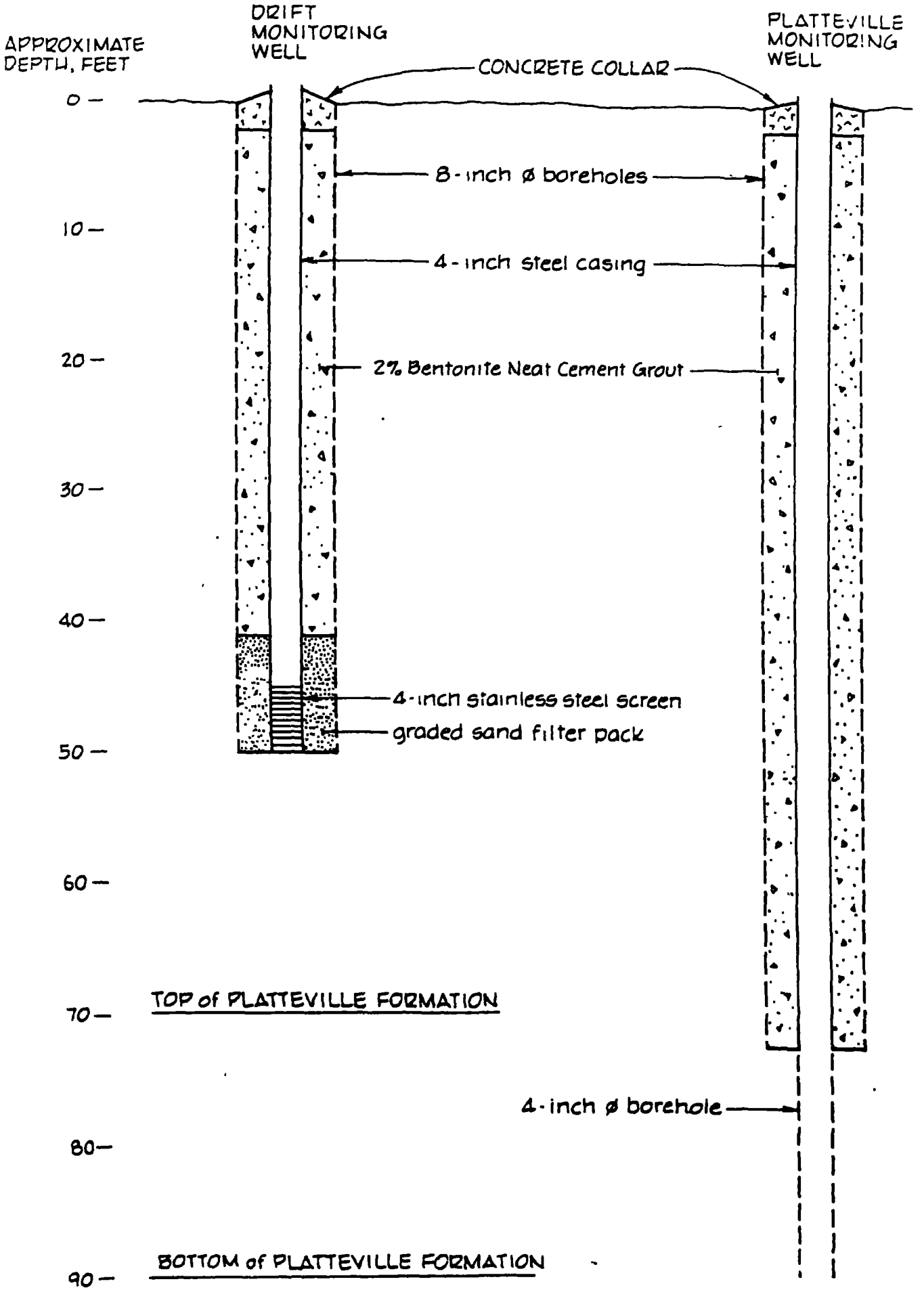


Figure 5 Conceptual Design of Observation Wells

(gpm). Discharge will be conveyed to the nearest sanitary or storm sewer. Appropriate permits for discharge will be obtained prior to commencing the test. The well head and the discharge line will be equipped with an In-Situ flowmeter and flow control valve (diaphragm-type with actuator) connected to the SE-200 Data Unit. This equipment will automatically measure and control the discharge rate.

The aquifer test will consist of three phases: an initial phase to determine antecedent trends, a pumping phase, and a recovery phase. During the initial phase, water levels will be recorded for a 48 hour period prior to pumping. The pumping phase will last approximately 72 hours. The exact duration will be determined based on data collected during the pump test. When water levels have stabilized to within 0.05 feet in 24 hours relative to background the pumping phase will be terminated. Water level measurements will be recorded every 10 seconds through the first two minutes, every 30 seconds the first five minutes, every minute through the first ten minutes, every 5 minutes through the first hour, every 15 minutes through the third hour, every 30 minutes through the fifth hour, every hour through the first day, and every four hours until the end of the pumping phase. Water levels will then be recorded during the recovery phase which will continue until water levels have stabilized near pre-test conditions. During the recovery phase water levels will be recorded every 10 seconds through the first two minutes, every 30 seconds the first five minutes, every minute the first ten minutes, every 5 minutes through the first hour, every 15 minutes through the third hour, every 30 minutes through the fifth hour, every hour through the first day, and every 4 hours until the end of the test.

Pumphouse Design and Construction

The design of the Drift gradient control well pumphouse is based on providing a structure and equipment suitable for what is assumed to be a long-term operation (possibly decades) with minimal maintenance and operating requirements. The pumphouse is designed as a 7'4" by 14'8" walk-in building with plenty of room for maintenance work. The roof is provided with a removable panel to allow for access to the well by a drill rig.

The Drift gradient control well pumphouse is designed to contain two gradient control wells. One well location will be taken by a St. Peter monitoring well (well "C") proposed by the City of St. Louis Park (the City) in its "St. Peter Aquifer Remedial Investigation Plan for the Reilly Tar & Chemical Corporation NPL Site, St. Louis Park, Minnesota" (submitted to the EPA, MPCA and MDH by the City on October 3, 1986 pursuant to Section 8.1.1 of the RAP). As noted in the St. Peter RI Plan, well C is located in a likely area for a St. Peter gradient control well, if the St. Peter RI/FS determines that such a well is needed. The other well location in the pumphouse will be taken by the Drift gradient control well. Providing a single pumphouse for the two wells will allow for improved operation, inspection and maintenance by the City.

The Drift gradient control well pumphouse will be a solidly-built masonary structure with a concrete floor. The wall structure will be masonry block with a brick veneer (color to be specified by the City of St. Louis Park) to make a more attractive building. Insulation will be

provided in the roof and walls and under the floor for energy efficiency. No access driveway is necessary for inspection and maintenance personnel because the pumphouse is adjacent to a large open parking area at the end of a deadend street. Electric heating and lighting and a floor drain will be provided inside the pumphouse. The floor drain will discharge via a gravity line to an existing sanitary sewer manhole on Oxford Street.

The Drift gradient control well pumphouse will be located on City-owned right-of-way for Oxford Street. The back of the pumphouse will be set partially into the foot of a railroad overpass embankment. The pumphouse floor will be set about one foot above existing grade at the front of the pumphouse. The finished grade will rise from 0.3 feet below the floor at the front of the pumphouse to 2.9 feet above the floor at the back.

Complete construction specifications and blueprints for the Drift gradient control well pumphouse are presented in Appendix C. These specifications will be used in obtaining bids and contracting for the construction work.

Piping Design and Construction

The piping design for the Drift gradient control well is also based on providing for long-term, low-maintenance operation. Galvanized pipe will be used from the wellhead to a point just outside the pumphouse, where carbon steel pipe wrapped with polyurethane insulation and a

polyethylene jacket will be used for the underground run to an existing sanitary sewer manhole in Oxford Street. The discharge line inside the pumphouse will be provided with a wellhead pressure gauge, followed by a shut-off valve, a flow controller, a flow meter, a reduced pressure backflow preventer, a sample tap, a downstream pressure gauge, and a check valve. The flow meter will signal a combined circular chart recorder/totalizer.

An underground discharge line (blinded off just outside the pumphouse) and underground electrical conduit will be provided for the possible future St. Peter gradient control well. This will eliminate the need to break up the pumphouse floor if a second gradient control well is installed in the building.

Complete construction specifications and blueprints for the Drift gradient control well discharge piping and sanitary sewer connection are also presented in Appendix C.

Contingent Actions for Contaminated Soils

The location of the Drift gradient control well relative to the former Reilly plant site is such that no soils contaminated with coal tar materials should be encountered during required excavation work.

Operation and Monitoring

Pumping of the Drift gradient control well will begin within 10 days of receiving approval of the construction from the EPA and MPCA Project Leaders. The well will be pumped at a monthly average rate of 50 gpm, as specified by RAP Section 9.2.3, until a request to cease pumping is approved pursuant to RAP Section 9.2.4. Reilly will notify the EPA and MPCA when the Drift gradient control well construction is completed and ready for their inspection and approval. Further details on the inspection, approval and start-up process are provided in Section 6.0 of the Quality Assurance Project Plan (Section B).

The Drift gradient control well will be operated by the City of St. Louis Park (the City) on behalf of Reilly Tar & Chemical Corporation (Reilly) in accordance with the Reilly/City Agreement (Exhibit B to the Consent Decree) beginning on the day that pumping is started. The City will inspect the pump operation at least twice per week for the well. All inspections will be noted in a log book using a form like the one shown in Figure 6. The flow meter totalizer reading, date, time, inspector's name, and any relevant comments will be recorded in the log during each inspection. The log book will be kept at the pumphouse, with a backup copy kept at City Hall. The log book and circular recorder charts will be maintained as permanent records by the City in accordance with applicable state and local statutes. The EPA and MPCA will be notified by the City before any of these records are destroyed.

FIGURE 6

INSPECTION LOG FOR THE DRIFT GRADIENT CONTROL WELL

Date	Time	Flow Totalizer Reading (gal)	Calculated Average Flow Rate (gpm) For Month-to-Date	Comments	Inspector's Name

The Drift gradient control well will be pumped continuously, except for brief shut-down periods required for maintenance and/or repair. The City will notify the EPA and MPCA Project Leaders of any shutdown lasting more than three working days, with an explanation of the cause and an estimated date when pumping will be restarted. Shut-down periods for maintenance or repair are expected to be brief and infrequent because of the simple equipment involved.

The Drift gradient control well will normally be pumped at a rate of 50 gpm, but this rate will be increased as required after shut-down periods in order to maintain a monthly average rate of 50 gpm. The monthly average rate will be calculated on a calendar month basis using the flow totalizer readings in the inspection log. Average flow rates for the month-to-date will be calculated and noted in the log book at least once a week to help ensure that the 50 gpm monthly average rate will be met each month. The circular charts from the flow recorder will not be used to determine compliance with the 50 gpm monthly average rate requirement because the totalizer gives more accurate readings. The circular charts are intended to document any variations in flow rate and any shut-down periods.

Monthly average pumping rates for the Drift gradient control well will be reported for the applicable calendar months in the progress reports required by Part K of the Consent Decree. In addition, the City will provide copies of the log book and circular charts to the EPA and MPCA Project Leaders on a monthly basis during the first year of operation.

Control of the well discharge rate will be accomplished using both the flow controller and the recorder/totalizer. The desired flow rate can be set initially by the scale on the flow controller. Over a period of hours or days, the totalizer readings can be used to check the flow rate and the initial controller setting adjusted accordingly. Once routine operation is established, the totalizer readings and times noted in the log book -- or the circular chart recorder reading -- can be used to check the flow rate and the flow controller setting adjusted as necessary.

The discharge from the Drift gradient control well will be monitored quarterly for Carcinogenic PAH, Other PAH and Phenolics, as specified by RAP Section 9.2.3. The monitoring will be performed by the City in accordance with the Reilly/City Agreement. In addition, Reilly will monitor the discharge from the Drift gradient control well for Carcinogenic PAH, Other PAH and Phenolics once during the first week of pumping. This initial monitoring is not required by the RAP, but is suggested by Reilly to aid in time-series analysis of the Drift gradient control well monitoring data. Sampling and analysis for this initial monitoring will be conducted by ERT using the procedures specified in the "Initial Sampling Plan for the Reilly Tar & Chemical Corp. NPL Site - St. Louis Park, Minnesota" (submitted to the EPA and MPCA by the City on October 3, 1986 pursuant to RAP Sections 3.2 and 3.3) as approved by the EPA and MPCA.

It should be noted that Section 2(c) of the Reilly/City Agreement requires that the discharge from the Drift gradient control well will be routed to the storm sewer before the fourth anniversary of the Effective Date of the Consent Decree. This change may require pretreatment of the

discharge, depending on the NPDES effluent limitations established pursuant to RAP Section 2.5. Discontinuance of the discharge to the sanitary sewer will be implemented in accordance with RAP Section 2.9.

Construction Report

Pursuant to Section 9.2.2 of the RAP, Reilly will prepare a report which presents the installation log for the Drift gradient control well, the results of the Drift aquifer test, and descriptions of any field adjustments to the approved design. The report will be submitted to the EPA and MPCA within the 120-day construction period specified by the RAP.

Construction Schedule

Section 9.2.2 of the RAP specifies that construction of the Drift gradient control well must be completed within "120 Days of receiving all necessary permits and approval of Äthisü plan, . . . whichever occurs last". The 120-day period allowed should be adequate for the required construction work if no major unexpected difficulties are encountered. The construction report will also be submitted within this 120-day period.

Figure 7 presents the detailed construction schedule currently planned for the Drift gradient control well work. This schedule is subject to modification as the work progresses, and Reilly makes no commitments to meeting any of the schedule dates other than the 120-day completion requirement specified in the RAP (subject to any extensions requested and granted in accordance with the Consent Decree). The schedule in Figure 7 is provided solely to assist the EPA, MPCA and City

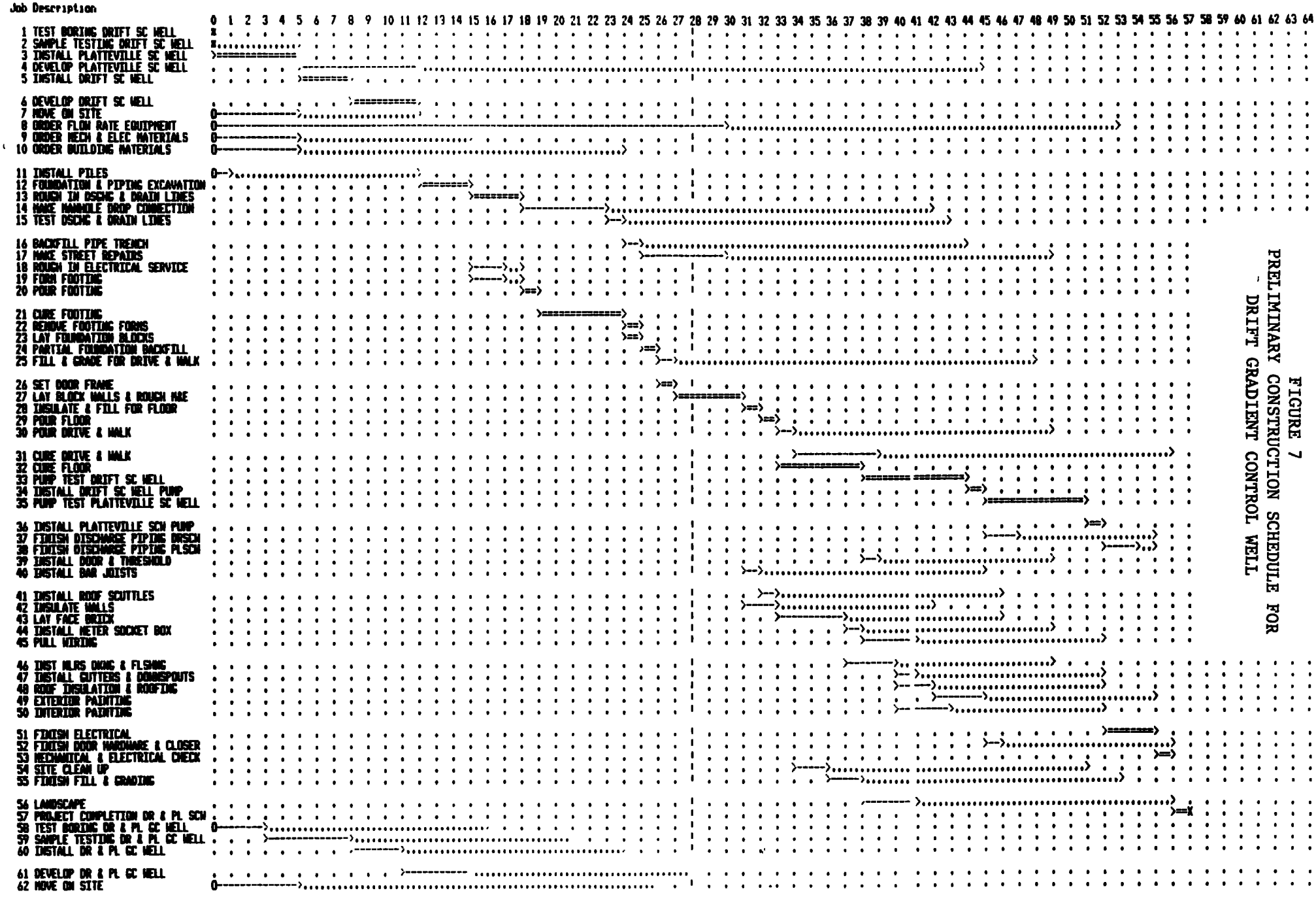
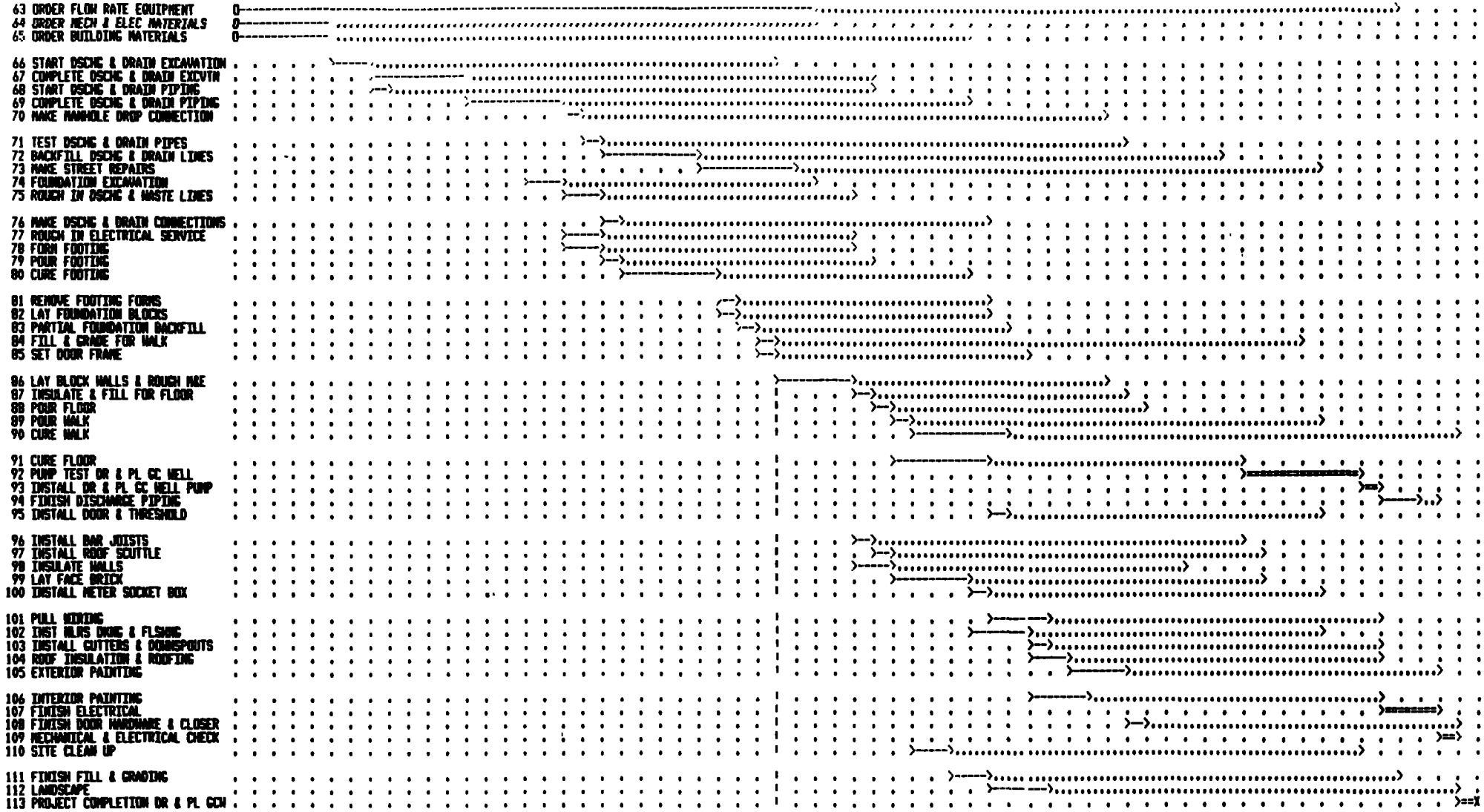


FIGURE 7
PRELIMINARY CONSTRUCTION SCHEDULE FOR
DRIFT GRADIENT CONTROL WELL



SORTING ORDER IS CURRENT ORDER
FROM THE FIRST JOB TO THE LAST JOB
JOBS USING ALL SKILLS

Symbol-Explanation
>--> Duration of a normal job
:..> Slack time for a normal job
>==> Duration of a critical path job
>::> Duration of a completed job
x Job with zero duration
+ Job deadline
0--> Job with no prerequisites
>--X Job with no successors
: Time break due to holiday or week-off

FIGURE 7
(CONT'D)

in planning inspections of the work. The Project Leaders for these entities will be provided with an updated schedule before beginning any on-site work and as required by major schedule changes after the work has started.

Figure 7 indicates a total schedule of 64 working days for completing the Drift gradient control well construction. This amounts to 88 calendar days if work is started on a Monday or Tuesday with a five-day work week. This schedule provides considerable flexibility relative to the 120-day period specified by the RAP.

The schedule in Figure 7 assumes that the work at the Drift gradient control well will proceed simultaneously with that at the Drift-Platteville source control wells. This will simplify the mobilization and logistics for installing the three wells and conducting the three aquifer pump tests. While this simultaneous approach is not required to meet the 120-day construction deadline, it would be helpful if all plan and permit approvals required for the Drift gradient control and Drift-Platteville source control wells could be granted simultaneously.

It is expected that the St. Peter monitoring well at the end of Oxford Street will already be installed before the Drift gradient control well work is started. Hence, the precise location of the pumphouse will be dictated by the location of the St. Peter monitoring well. Necessary precautions will be taken to ensure that the Drift well installation and pumphouse construction does not damage the St. Peter well.

As indicated above, Section 9.2.2 of the RAP specifies that the 120-day construction period starts when Reilly receives approval of this plan and receives all necessary permits, whichever occurs last. Reilly is required to obtain various permits from the City as well as the DNR and MWCC permits specified in RAP Section 9.2.1. In order to comply with Part T of the Consent Decree (Other Applicable Laws), the EPA and MPCA have agreed to make their approval of this plan effective upon the day that the City issues the required permits, provided that this occurs within 60 Days of Reilly's receipt of the approval letter. Reilly will submit the required City permit applications promptly after receiving approval of this plan from the EPA and MPCA, and will provide copies of the City permit applications to these agencies. Reilly will notify the EPA and MPCA by certified mail promptly after receiving the last of all required City, DNR and MWCC permits, and the 120-day construction period will begin on the day that Reilly receives the last required permit.

SECTION B
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN
FOR DRIFT-PLATTEVILLE AQUIFER GRADIENT CONTROL WELL AT THE RTCC - ST. LOUIS PARK SITE

ERT Document No. QAD722-292

October 1986

Amended January 1987

Prepared for

REILLY TAR & CHEMICAL CORPORATION
INDIANAPOLIS, INDIANA

ERT - A RESOURCE ENGINEERING COMPANY
696 Virginia Road, Concord, Massachusetts 01742

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

ERT and the Reilly Tar & Chemical Corporation (RTCC) will complete certain tasks in fulfillment of the Consent Decree and Remedial Action Plan (RAP) for the St. Louis Park Site. This Quality Assurance Project Plan pertains to all work to be performed by ERT, RTCC and subcontractors in completing the requirements of Section 9.2 of the RAP. Section 9.2 concerns gradient control actions in the Drift-Platteville Aquifer in the vicinity of the St. Louis Park Site. This work will involve the installation of a gradient control well at a depth of approximately 65 feet, installation of a pump; and conducting a pumping test. Further details on the work to be performed, its purpose and the methodology to be employed may be found in the project Site Management Plan.

1.2 Quality Objectives

The purpose of this Quality Assurance Project Plan is to define the Quality Assurance and Quality Control provisions to be implemented to ensure that:

- The resulting gradient control well conforms to design specifications given in the project Site Management Plan.

- The work is performed in an efficient manner.
- Field records generated during the course of the field work are sufficiently complete and accurate to satisfy data analysis and report requirements.
- All assumptions, formulae, interpretations and numerical analyses used in the process of deriving reported results and conclusions are documented in permanent records.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization is illustrated in Figure 2-1. The RTCC Project Manager, Mr. John Craun will oversee and coordinate all project activities. The ERT Project Manager/Field Coordinator, Mr. William Gregg, will schedule and direct all field activities, including the design and implementation of the aquifer test, and will conduct correspondence with RTCC. The ERT Project Manager/Field Coordinator is also responsible for maintaining records of the work performed on the project and for archiving those records in the Central File upon completion of the work. The RTCC Engineering Manager, Mr. Lewis Locke will direct the engineering aspects of the work, including the installation of the sewer line connection and pump house. The Project Quality Assurance Officers are responsible for ensuring that this plan is implemented by their respective organizations, and that project data undergo technical and peer review, as necessary. The pump installation contractor will perform all work necessary to install the pump and make it operational. The sewer line connection subcontractor will

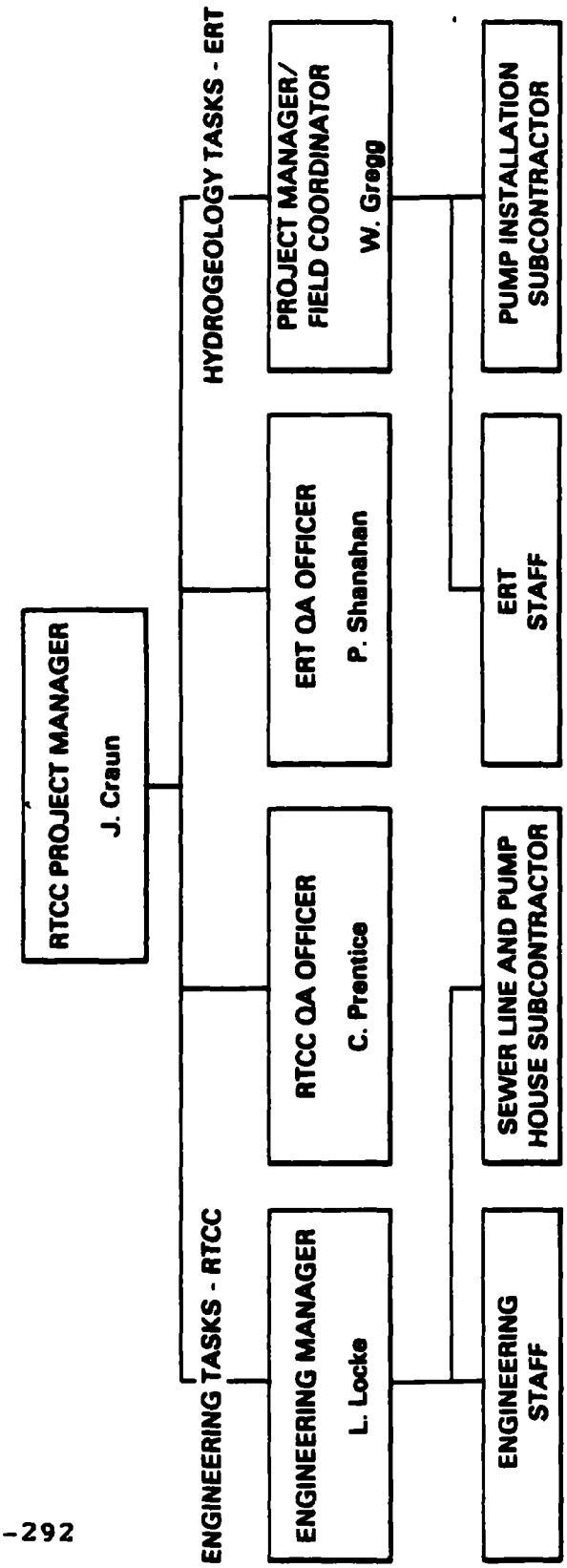


Figure 2-1 Project Organization

install piping and the connection to the sewer line and will install the well house to enclose the well and pump.

3.0 QA/QC - FIELD ACTIVITIES

3.1 Training

In order to ensure that the two subcontractors doing the field work can do so in a cooperative and efficient manner, instruction and guidance will be provided by the RTCC Project Manager and the ERT Project Manager/Field Coordinator to instill an understanding of the project objectives and plans and of the respective roles of the subcontractors.

3.2 Subcontractor Quality Control

Subcontractor quality control is that system of activities which ensures that products or services obtained from subcontractors fulfill the needs of the project. Subcontractor quality control begins with subcontractor procurement. The project policy for control of procurement is described in the ERT Quality Assurance Manual for Hazardous Waste Site Investigations, Chapter 5. The subcontractor procurement process considers:

- Bidder's qualifications in terms of personnel and physical resources, Quality Assurance program and Health and Safety program,

- Results of pre-qualification audits, if appropriate,
- Price and technical qualifications

Periodic quality control inspections of each contractor will be performed by the RTCC Engineering Manager and the ERT Project Manager/Field Coordinator to evaluate adherence to the QA Project Plan and the project Health and Safety Plan. Inspection will include (as appropriate):

- Type and condition of equipment,
- Calibration procedures,
- Personnel qualifications,
- Decontamination procedures,
- Documentation.

Results of the inspection will be entered in the field notebook.

3.3 Document Control and Recordkeeping

Document Control for the Drift-Platteville Aquifer Gradient Control Well work serves a two-fold purpose. It is a formal system of activities that ensures that:

1) All participants in the project are promptly informed of revisions of the Quality Assurance Project Plan; and
2) All critical documents generated during the course of the work are accounted for during, and at the end of the project.

This QA Project Plan and all Standard Operating Procedure documents have the following information on each page:

- Document Number
- Page Number
- Total number of pages in document
- Revision number
- Revision date

When any of these documents are revised, the affected pages are reissued to all personnel listed as document holders with updated revision numbers and dates. Issuance of revisions is accompanied by explicit instructions as to which documents or portions of documents have become obsolete.

Control of, and accounting for documents generated during the course of the project is achieved by assigning the responsibility for document issuance and archiving. For the Drift-Platteville Aquifer Gradient Control Well work, the RTCC Project Manager and the ERT Project Manager/Field Coordinator have this responsibility.

Documentation for the project will either be recorded in non-erasable ink, or will be photocopied promptly upon completion, and the photocopies dated. All documents will be signed by the person completing them.

4.0 AQUIFER TEST

The aquifer test will be performed in accordance with ERT SOP No. 7730, Aquifer Test and Data Evaluation, and the project Site Management Plan. Any differences in the procedures described in these documents will be resolved by following the Site Management Plan.

5.0 NUMERICAL ANALYSIS AND PEER REVIEW

All numerical analyses, including manual calculations, mapping, and computer modeling will be documented and subjected to quality control review in accordance with ERT SOP 2005, Numerical Analysis and Peer Review. All records of numerical analyses will be legible, reproduction-quality and complete enough to permit logical reconstruction by a qualified individual other than the originator.

6.0 AUDITS AND CORRECTIVE ACTION

ERT conducts periodic audits to assess the level of adherence to QA policies, procedures and plans.

Whenever quality deficiencies are observed that warrant immediate attention, formal corrective action request forms are issued to the project manager by the Quality Assurance Department. The QA Department retains one copy of the form when it is issued. The project manager completes the form and signs it when corrective action has been implemented, and returns the original to the QA Officer to close the loop.

The Quality Assurance Department maintains a record of all corrective action requests and reports their status to ERT management in a quarterly report.

Should an audit be conducted on the Drift-Platteville Gradient Control Well work activities, RTCC will be apprised of the audit findings and of any corrective action that is requested and performed.

7.0 CONSTRUCTION APPROVAL

The Reilly Project Leader (or Alternate) will provide written notification to the U.S. EPA, MPCA and City Project Leaders within 3 days of completing construction of the Drift gradient control well system. Following receipt of such notification, the U.S. EPA, MPCA and City Project Leaders (or their designees) will inspect the system and Reilly will demonstrate that the system has been construced and operates in accordance with the approved Drift gradient control well plan. Following their inspection of the system, the U.S. EPA and MPCA Project Leaders (or Alternates) will notify the Reilly Project Leader in writing as to whether the Drift gradient control well system is approved or disapproved. In the event that the system is approved, the City will commence operation of the system within 5 days of Reilly's receipt of the approval letter. In the event that the system is disapproved, the U.S. EPA and MPCA Project Leaders will explain in writing the basis for the disapproval and the items that need to be corrected, and Reilly will either correct the items or explain in writing why the system

should be approved as constructed. If corrections are made, the notification, inspection, and approval/disapproval sequence described above will be repeated.

The U.S. EPA, MPCA, City and Reilly recognize that the inspection and approval procedure described above represents procedures beyond those required by Section 9.2 of the RAP. The U.S. EPA and MPCA therefore agree that, with respect to the provisions of Part M of the Consent Decree, Reilly will be deemed to have met the schedule requirements specified in Section 9.2 of the RAP if the Reilly Project Leader provides notice that the Drift gradient control well construction is complete within 60 days of the start of the construction period and if the City commences operation of the Drift gradient control well system within 5 days of Reilly's receipt of approval of the construction.

Notwithstanding the procedures described above, the City, U.S. EPA, MPCA and Reilly reserve all of their rights under the Consent Decree for dispute resolution, extension requests and related actions with respect to the construction, inspection, approval and operation of the Drift gradient control well system.

SECTION C
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

for the

Reilly Tar & Chemical Corporation
St. Louis Park, Minnesota Site
Drift-Platteville Gradient Control Well

Project Number: D722-295

Division Number: 120

Date: January 2, 1987

Prepared By: Kevin Powers

Date: January 2, 1987

Approved By: John Chram for Peter Shanahan

Date: 1/28/87

Kevin Powers
Health & Safety Manager

Date: 1/27/87

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HEALTH AND SAFETY PLAN

1.0 Introduction

This health and safety plan applies to on-site personnel who will potentially be exposed to soil and/or groundwater contamination during the construction of the Drift-Platteville gradient control well near the Reilly Tar & Chemical Corporation, St. Louis Park site. This plan has been designed to comply with, as a minimum, the requirements set forth in 29 CFR 1910.120, the OSHA standards governing hazardous waste operations. The ERT Project Manager and project staff will be responsible for continuous adherence to the safety procedures during site work at St. Louis Park. In no case may work be performed in a manner that conflicts with the intent of or the safety concerns expressed in this plan. Other contractors and subcontractors involved in this project will be required to adhere to this safety plan, as a minimum, and to conduct all work in accordance with applicable health and safety regulations, including 29 CFR 1910.120.

2.0 Site Description and History

Reilly Tar & Chemical Corporation (RTCC) operated a creosote wood preserving plant and coal tar refinery in St. Louis Park, Minnesota from 1917 to 1972. In 1972 the plant site was sold to the City of St. Louis Park and the plant was removed. The 80-acre site was subsequently converted to a variety of productive uses, including an apartment complex, some commercial buildings, a new roadway and a large open park. Contamination by creosote and coal tar-related materials of soil, shallow ground water and a deep bedrock well have occurred at the site. Also, certain coal tar-related chemicals have been found in portions of deep bedrock aquifers in the St. Louis Park area.

3.0 Scope of Work

Specific work activities at the site will include the installation of a new pumping well, connection of the well discharge to the sanitary sewer, and erection of a brick-and-block wellhouse. A trench will be dug from the wellhouse to the sanitary sewer in order to make the discharge connection.

Exposure to the contaminants described below may occur during the performance of these activities.

4.0 Contaminants of Concern and Effects of Overexposure

The contaminants of concern which have been identified at this site are coal tar and creosote related materials including naphthalene, other polynuclear aromatic hydrocarbons (PAH) and phenolic compounds.

Coal tar and creosote are typically irritating to the eyes, skin and respiratory tract. Acute skin contact may cause burning and itching while prolonged contact and poor hygiene practices may produce dermatitis. Prolonged skin contact with creosote must be avoided to prevent the possibility of skin absorption.

Naphthalene is a hemolytic agent which, upon overexposure to the vapor or ingestion of the solid, may produce a variety of symptoms associated with the breakdown of read blood cells. Naphthalene is also irritating to the eyes and repeated or prolonged contact has been associated with the production of cataracts.

Repeated exposure to certain PAH compounds has been associated with the production of cancer. Contact of PAH compounds with the skin may cause photosensitization of the skin producing skin burns after subsequent exposure to ultraviolet radiation.

Phenolics are generally strong irritants which can have a corrosive effect on the skin and can also rapidly penetrate the skin. Overexposure to phenols and phenolic compounds may cause convulsions as well as liver and kidney damage.

5.0 Hazard Assessment

5.1 Initial

Because of the relatively low vapor pressures associated with PAH compounds (generally less than 10^{-4} mm Hg at 20°C), they are not expected to present a vapor hazard at this site. The most likely threat of exposure to these compounds will be via skin contact.

Although naphthalene and phenol also have relatively low vapor pressures (0.05 and 0.36 mm Hg at 20°C, respectively) there is a possibility that these substances may produce vapor hazards at this site under adverse conditions.

5.2 Continuing Hazard Assessment On-Site

Air Monitoring

An HNU Photoionization Detector (PID) equipped with a 10.2 eV lamp will be used to provide semiquantitative data on VOC concentrations in and around the breathing zone of workers. Air sampling will be conducted by taking and recording periodic readings in the breathing zone at each of the following locations:

- In the breathing zone near the opening of the well being drilled.
- In the breathing zone over freshly-exposed soil being excavated.

TABLE 1

ACTION LIMITS FOR AIR CONTAMINANTS

Limit	Persistent Concentration in the Breathing Zone	Procedure
Lower	5 ppm	Don respirators, step up monitoring.
Upper	50 ppm	Stop work and back off from immediate work area until levels subside in the breathing zone.

Action Limits

The American Conference of Governmental Industrial Hygienists (ACGIH) has established threshold limit values (TLV) for phenol and naphthalene at 5 and 10 ppm, respectively, as 8-hour time weighted averages (TWA). Based on these values, the action limits in Table 1 have been set. The lower limit of 5 ppm is based on the TLV for phenol while the upper limit of 50 ppm is based on a minimum protection factor of 10 for a half-mask, air purifying respirator.

Response

When the PID yields persistent breathing-zone readings at or above the lower action limit, workers in the affected area will don respirators. Air sampling will continue on a more frequent basis. If readings are persistent at or above the upper limit, workers shall back off from the immediate work area until measured breathing- zone concentrations fall below the lower limit, at which time operations will resume and normal air monitoring will continue. If breathing zone levels do not fall below the upper limit, workers are to leave the work area and report the condition immediately to the Health and Safety Manager. If necessary, engineering controls will be instituted to maintain vapor concentrations below the upper limit or arrangements will be made to upgrade to Level B protection.

6.0 Personal Protective Equipment

Personal protective equipment (PPE) will be donned, as necessary, based on the hazards encountered. Listed below is the personal protective equipment to be utilized during this project and the conditions requiring its use.

Personal Protective Equipment

- Coveralls - Polyethylene coated Tyvek if work involves contact with contaminated soil or ground water.
- Boots - Chemical resistant type if work involves contact with contaminated soil or groundwater.
- Hard Hat - When working in the vicinity of operating heavy machinery (i.e., drilling rig, backhoe, etc.)
- Face shield - If splash hazard exists.
- Gloves - Nitrile for potential contact with contaminated soil or ground water.
- Respirator - MSA Comfo II with GMC-H Cartridges if PID reading exceeds 5 ppm or if dust or odors become objectionable.
- Chemical Safety Goggles - If eye irritation occurs.

Because of the carcinogenicity of certain PAH compounds, and because of the skin hazards associated with PAH and phenolic compounds, it is important that appropriate protective clothing be worn during work activities, such as drilling and excavation, which may involve the possibility of skin contact with contaminated soil or ground water. As a minimum, the presence of visible creosote or coal tar-related material shall constitute evidence of contaminated soil or groundwater.

7.0 Health and Safety Training

Site personnel covered by this health and safety plan must have received appropriate health and safety training prior to their working on the site. Training will include:

- Requirements for ERT employees to have received the baseline medical examination within one year of on-site work.

- Requirements for and use of respirators and personal protective equipment.
- Cautions regarding the potential for trench collapse.
- Required personal hygiene practices.
- Requirements for employees to work in pairs.
- Proper material handling.
- Proper sampling procedures.
- Maintenance of safety equipment.
- Effective response to any emergency.
- Responses to fires and explosions.
- Emergency procedures (e.g., in the event of a trench collapse).
- Hazard zones.
- Decontamination methods.
- General safety precautions.

A copy of the Standard Safety Procedures (Table 2) will be given to each worker covered by this health and safety plan.

8.0 Decontamination

Administrative procedures require hygienic practices consistent with work hazards. Employees will be instructed in the training program on proper personal hygiene procedures.

Contaminated, reuseable PPE, such as boots, hard hats, face shields and goggles, will be decontaminated prior to leaving the site. The decontamination procedure follows.

- Rinse with water to removed gross contamination.
- Wash in Alconox or equivalent detergent solution.
- Rinse with clean water.

Contaminated, disposable PPE, such as Tyvek coveralls and gloves will be placed in 55-gallon drums and stored on site while arrangements are made for disposal.

TABLE 2

STANDARD SAFETY PROCEDURES

RTCC ST. LOUIS PARK SITE

- ERT employees are required to have a baseline medical examination within one year of on-site activity.
- Employees are required to work in pairs.
- Wash face and hands prior to eating, smoking, or leaving the site.
- No smoking or eating is allowed in the work area during active drilling, excavation or sampling activities.
- Wearing of contact lenses is not permitted in the work area.
- Contaminated material (e.g., Tyvek coveralls) must be properly disposed of before leaving the site.
- All work must be conducted in accordance with local, state and federal EPA and OSHA regulations, particularly 29 CFR 1910.120.
- The walls of trenches greater than 4 feet in depth must be sloped back to the angle of repose prior to entering. For average soil, an angle of 45^{o} is recommended.

Respirators, if used, will be cleaned and disinfected after each day of use. The facepiece (with cartridge removed) will be washed in a hypochlorite (or equivalent) disinfecting solution, rinsed in warm water and air dried in a clean place.

9.0 Emergency Procedures

This Health and Safety Plan has been established to allow site operations to be conducted without adverse impacts on worker health and safety as well as public health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions at the site.

9.1 General

All accidents and unusual events will be dealt with in a manner to minimize a continued health risk to site workers. In the event that an accident or other unusual event occurs, the following procedure will be followed:

- First aid or other appropriate initial action will be administered by those closest to the accident/event. This assistance will be conducted so that those rendering assistance are not placed in a situation of unacceptable risk. In the event that a worker is caught in a trench collapse, call for emergency assistance immediately.
- All accidents/unusual events must be immediately reported to the ERT Health and Safety Manager, the ERT Project Manager, and the other contacts listed in Table 3.
- All workers on site should conduct themselves in a mature, calm manner in the event of an accident/unusual event, to avoid spreading the danger to themselves, surrounding workers and the community.

9.2 Responses to Specific Situations

Emergency procedures for specific situations are given in the following paragraphs.

Worker Injury

If an employee in a contaminated area is physically injured, Red Cross first-aid procedures will be followed. Depending on the severity of the injury, emergency medical response may be sought. If an excavation collapses and a worker is caught, call for emergency assistance immediately. If the person is in no immediate danger, do not attempt to move him. Internal injuries could be worsened. If the employee can be moved, he will be taken to the edge of the work area (on a stretcher, if needed) where contaminated clothing (if any) will be removed, emergency first-aid administered, and transportation to a local emergency medical facility awaited.

If the injury to the worker is chemical in nature (e.g., overexposure), the following first-aid procedures are to be instituted:

- Eye Exposure - If contaminated solids or liquids get into the eyes, wash eyes immediately using large amounts of water and lifting the lower and upper lid occasionally. Obtain medical attention immediately.
- Skin Exposure - If contaminated solids or liquids get on the skin, promptly wash the contaminated skin using soap or mild detergent and water. Obtain medical attention immediately when exposed to concentrated solids or liquids.
- Inhalation - If a person inhales large amounts of a toxic vapor, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

- Swallowing - When contaminated solids or liquids have been swallowed, the Poison Control Center will be contacted and their recommended procedures followed.

9.3 Notification

Checklist

The names and phone numbers of all personnel and agencies that could be involved in emergency responses have been determined. Table 3 provides the notification checklist for use at the St. Louis Park site.

Documentation

The ERT Project Manager will provide a report to the Health and Safety Manager containing the following information regarding any incidents implicating health and safety concerns:

- The event (including date and time) that necessitated the notification and the basis for that decision.
- Date, time, and names of all persons/agencies notified and their response.
- Resolution of the incident (including duration) and the method/corrective action involved.

This report will be submitted within five working days of the resolution of the event.

TABLE 3

NOTIFICATION CHECKLIST

RTCC, ST. LOUIS PARK SITE

In the event of an extraordinary event that might be damaging to personnel or adjacent property, immediate notification of the proper emergency service will be required. The proper emergency service is determined by the nature of the emergency.

EMERGENCY NOTIFICATION

Fire Department	920-2345
Ambulance	920-2345
Police Department	920-2345
Methodist Hospital	932-5000
Poison Control Center	347-3141

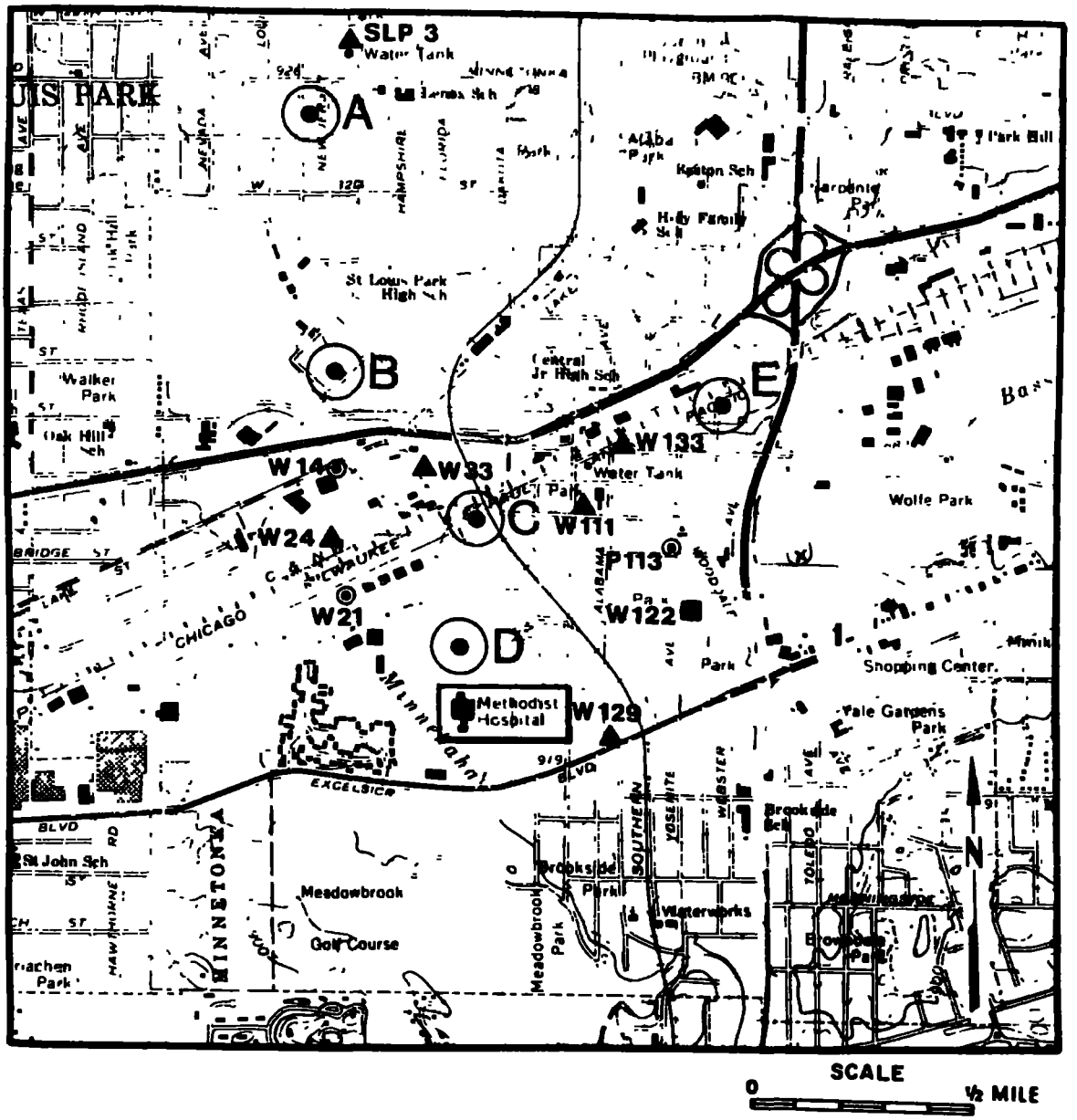
Directions to Methodist Hospital: From the site on Louisiana Ave., south to highway 7 (approximately 0.2 mile). Go east on highway 7 to Brunswick Ave. (approximately 0.6 mile). Turn right on Brunswick and proceed south to Excelsior Blvd. (approximately 0.8 mile). Turn right on Excelsior and proceed west past Dakota Ave. (approximately 0.2 mile). Methodist Hospital is on the right side of excelsior Blvd., immediately after Dakota Ave. (See attached map).

ERT CONTACTS

Health & Safety Mgr. - Kevin Powers (HSM)	617-369-8910
Project Manager - William Gregg (PM)	617-541-1642

OTHER CONTACTS

MPCA - Douglas J. Robohm	612-296-7288
EPA - Daniel J. Bicknell	312-886-7341
RTCC - John C. Craun	317-248-6426
City of St. Louis Park - James N. Grube.	612-924-2551



EXPLANATION

▲W33 LOCATION AND PROJECT WELL NUMBER

▲ OBSERVATION WELL COMPLETED IN ST. PETER AQUIFER

■ OBSERVATION WELL COMPLETED IN BASAL ST. PETER CONFINING BED

◉ PROPOSED ST. PETER MONITORING WELLS

◉ WELL IN WHICH WATER LEVELS WERE MONITORED WITH A DIGITAL RECORDER DURING PART OF 1978-81

SECTION D
COMMUNITY RELATIONS PLAN

Construction of the Drift aquifer gradient control well will be undertaken pursuant to the provisions of the Consent Decree and Remedial Action Plan for the Reilly Tar & Chemical Corporation St. Louis Park, Minnesota NPL site. All community relations programs related to this work will be coordinated through the following agencies:

United States	Ms. Judy Beck U.S. Environmental Protection Agency Region V (312) 353-1325
State of Minnesota	Ms. Sharon Brustman Minnesota Pollution Control Agency (612) 296-7769
City of St. Louis Park	Ms. Sharon Klumpp City of St. Louis Park (612) 924-2523

APPENDIX A

HEAD LOSS CALCULATIONS

APPENDIX A

HEAD LOSS CALCULATIONS

The pump size for the Drift gradient control well is based on the need to pump 50 gpm of water against 140 feet of head, with some margin for higher pumping rates to make up for down time. The total discharge head is comprised of the following head losses:

Item	Feet of Head
Net head lift	46
Pipe & fitting losses	13
Equipment losses	81

	140

The pipe and fitting losses were calculated using standard friction factors. The equipment losses are comprised of 21 feet of head across the backflow preventer, 25 feet across the flow meter, and 35 feet across the flow controller.

The net head lift was estimated from recent water level data and predicted drawdowns. Water levels measured by the MPCA in Drift observation wells in January 1985 indicate a groundwater elevation of about 883 feet in the vicinity of the proposed gradient control well (see Figure 8 in the Drift-Platteville Aquifer Northern Area Remedial Investigation Plan submitted by the City of St. Louis Park in January 1987). The aquifer analysis and aquifer parameters presented in the Aquifer Testing Plan section of the Site Management Plan yield a predicted drawdown on the order of a few feet when pumping the Drift

gradient control well at 50 gpm. However, to be conservative and allow for possible declines in static water levels, a drawdown of 27 feet was assumed in estimating net head lifts. Finally, drawing no. 861637-300 shows that the design elevation of the discharge line below the pumphouse is about 902 feet (192 feet by St. Louis Park datum). With the information given above, the net head lift for the Drift gradient well can be calculated as: 902 - 883 + 27 = 46 feet.

APPENDIX B

ERT STANDARD OPERATING PROCEDURES 7730

AQUIFER TEST AND DATA EVALUATION

Note: Discrepancies between this SOP and the Site Management Plan will be resolved by following procedures described in the Site Management Plan.

STANDARD OPERATING PROCEDURE

Number: 7730 Date of Issue: 2nd Qtr. 1986

Title: AQUIFER TEST AND DATA EVALUATION

Organizational Acceptance	Authorization	Date
Originator	[signature]	5/27/86
Department Manager	[signature]	5-27-86
Divisional Manager	D E Andrews	5/28/86
~~Group~~ Quality Assurance ~~Officer~~ Manager	Scott M. Whittemore	5-27-86
Other		

Revisions	Changes	Authorization	Date

1.0 PURPOSE/APPLICABILITY

This SOP is concerned with the procedures necessary for aquifer-test design, aquifer-test performance and general techniques of data evaluation. The scope of this SOP is limited to general procedures necessary to properly understand and organize an aquifer test. A detailed test plan should be prepared before beginning an aquifer test, following the general guidelines given in this SOP. More detailed studies concerning aquifer tests and analyses can be found in any of the various references listed at the end of this SOP.

Aquifer tests are generally conducted to evaluate the hydraulic properties of an aquifer system as they relate to remedial action design criteria and/or water supply studies.

2.0 RESPONSIBILITIES

The project manager or his delegate (a qualified hydrologist, hydrogeologist, geologist, etc.) will have the responsibility of designing an appropriate aquifer-test program specific to the project needs. Additionally, he or she will be responsible for coordinating any second or third parties and ensuring that all procedures are performed in accordance with SOP and the aquifer-test plan. Any deviation from the SOPs or the aquifer-test plan will be fully documented in a daily log book.

2.1 ERT Personnel

The ERT project manager or his delegate will be responsible for:

- Aquifer-test design - This will include review of pertinent hydrogeologic literature (reports, boring and well logs, etc.) and, based on that information, the preparation of a site-specific aquifer-test plan that specifies: (1) the placement of monitoring and recovery wells; (2) site-specific discharge rates and point of discharge; and (3) time intervals at which water level data will be collected.
- Aquifer-test performance - This includes: (1) implementation of the aquifer test in accordance with job-specific protocols given in the aquifer-test plan; and (2) recording aquifer-test data.
- Reduction and evaluation of aquifer-test data - This will include: (1) evaluation of antecedent water-level trends; (2) evaluation of the pumping phase water-level data; and (3) evaluation of the recovery phase water-level data.

2.2 Drillers

It is the responsibility of the driller to provide the necessary equipment for monitoring and recovery well installation as specified in SOP 7220 and as modified by the project manager or his delegate. If the driller is to supply submersible pumps, generators, flow meters, discharge lines or any other equipment necessary to the job the project manager shall explain in detail to the subcontracted driller the job-specific equipment needs. During setup and/or installation of the equipment the project manager shall oversee the performance and adherence to the test plan. Additionally, during the entire aquifer test, if the driller is involved in activities such as monitoring the performance of the pumps, fuel supplies, etc., the project coordinator shall ensure that the driller adheres to the test plan.

2.3 Second or Third Parties

During the aquifer test other involved parties shall be monitored for performance and adherence to the test plan. Any deviation shall be corrected and fully recorded by the project coordinator in a daily log book.

3.0 SUPPORTING MATERIALS

The following list identifies the types of equipment which may be used during an aquifer-test program. Exact equipment needs will be project-specific and will be detailed in the aquifer-test plan.

3.1 ERT

- Electric water-level indicator
- Steel surveyors tape and plopper
- Pressure transducer and data logging system
- 100-foot surveyors tape
- Field portable printer or computer (compatible with data logging system)
- Aquifer-test record sheets/clip board
- Daily log book

- Log-log and semi-log graph paper
- Watch
- Calculator
- Decontamination equipment (required for personal protection during aquifer tests in potentially contaminated environments or if sampling for chemical analysis will be included):

  Alconox detergent
  Chemical-free paper towels
  Deionized water w/squeeze bottle
  Methanol w/squeeze bottle
  Trash bags
  Tap water (5 gallons)
  Buckets

- Ground-water sampling kit from lab (if applicable)
- Personnel health and safety equipment (as specified by the HSO)
- Submersible pump
- Aeration column (for stripping volatiles out of discharged ground water)

3.2 Driller

- Tankers for collecting discharged ground water
- Submersible pump
- Generator and fuel
- Flow meters and control valves
- Discharge line

3.3 Supporting SOPs

- 2005 - Numerical Analysis and Peer Review
- 7220 - Monitoring Well Construction and Installation

4.0 GENERAL AQUIFER TEST DESIGN AND OPERATIONAL PROTOCOLS

Aquifer tests are broken down into four separate phases, all of which must be performed for proper evaluation of the hydraulic properties of the aquifer. Any deviation from these four phases must be fully documented and justified. These four phases are:

- Aquifer-test design
- Antecedent water-level monitoring
- Pumping
- Recovery

Aquifer-Test Design

Prior to an aquifer test an initial review of site hydrological and geological conditions must be performed and a detailed aquifer-test plan must be prepared. Information concerning aquifer thickness, aquifer type, transmissivity, hydraulic conductivity, storativity, etc., can be obtained or estimated from the following types of sources:

- Boring logs
- Well records
- USGS water resource reports
- State water resource reports
- Textbook tables and charts

The hydrogeologic information gathered from these sources is necessary to:

- estimate the cone of influence at a specific discharge rate;
- properly and strategically locate monitoring wells and the recovery well; and
- determine the proper time intervals at which time-drawdown data should be collected.

The following subsections provide guidelines for preparation of aquifer-test plans.

4.1.1 Cone of Influence

The cone of influence which will result from pumping of the aquifer must be estimated for proper placement of monitoring wells. Analysis of the cone of influence is performed using: (1) analytical techniques described in Section 5.0; (2) known and/or estimated hydraulic characteristics of the aquifer system; and (3) the project-specific discharge rate.

4.1.2 Recovery Wells

Recovery well design is mainly dependent upon the heterogeneity of the aquifer system to be tested. Standard design considerations which should be evaluated under all situations are as follows:

- The inside diameter of the recovery well and well screen should be sufficient to allow for installation of the submersible pump.
- The well screen should be of sufficient slot-size opening to prevent entrainment of finer grained sediment while keeping the screen intake velocity and head loss at a minimum.
- The recovery well should be properly developed prior to the aquifer test.

The screened interval of the recovery well is dependent upon the heterogeneity of the aquifer system. Under fairly homogeneous, isotropic conditions the recovery well should be screened over 70 to 80 percent of the aquifer's entire thickness. More heterogeneous, anisotropic conditions may require a specific screened interval dependent upon the formational unit to be tested. Under complex heterogeneous anisotropic conditions the placement of the recovery well screen must be evaluated by a qualified hydrogeologist.

4.1.3 Monitoring Wells

Monitoring well design is largely dependent upon the heterogeneity of the aquifer system to be tested. Standard design considerations which should be evaluated under all situations are as follows:

- The inside diameter of the monitoring well should be sufficient to allow for installation of water-level monitoring equipment and ground-water sampling equipment.

- A minimum of five monitoring wells should be used for the collection of water level and drawdown data.

- Monitoring wells should be properly developed prior to the aquifer test to ensure proper hydraulic continuity with the aquifer system.

Under fairly homogeneous, isotropic conditions the following rules for proper monitoring well placement should be observed:

- Monitoring well screens should extend to at least a depth equal to the midpoint of the recovery well.

- The closest monitoring well should be located at a radial distance, from the recovery well, equal to the saturated thickness of the aquifer.

- At least one monitoring well should be located outside of the predetermined cone of influence.

- For a confined aquifer, shallow monitoring wells should be placed in the overlying source bed (if any).

Figure 1 shows a typical setup of monitoring wells and the recovery well along with major assumptions for homogeneous, isotropic conditions. More heterogeneous, anisotropic aquifer systems may require discreet screen placement within specific geologic units. This placement shall be determined by a qualified hydrogeologist.

4.2 Antecedent Water-Level Monitoring

Antecedent water-level trends must be established prior to startup of the recovery well pump. Antecedent water-level trends include:

- Diurnal fluctuations due to daily ground-water withdrawals in the area

- Seasonal water-level fluctuations

- Changes in water levels due to changes in the atmospheric barometric pressures
- Changes in water levels due to tidal cycles
- Changes in water levels due to daily traffic patterns

Dedicated, continuously recording, pressure transducers and data logging systems should be employed to establish antecedent water-level trends. Water levels should be monitored at no greater than hourly intervals in at least three monitoring wells to establish any spatial trends within the aquifer system. Data should be collected until a water level trend can be established but for no less than a 24-hour period. The observed antecedent trend also can be used to locate possible ground-water supply wells which may cause interference during the aquifer test. All efforts should be made to reduce the use of any well which may cause interference during the aquifer test.

During analyses of the aquifer-test data, antecedent water-level trends are extrapolated out through the pumping and recovery phases of the aquifer test. Water level and drawdown data are then corrected for any established antecedent trend.

4.3 Pumping Phase

During the pumping phase of the aquifer test the recovery well pump is switched on and run at the specified discharge rate. All technicians who will be collecting data shall synchronize their watches and begin collecting water level data when the recovery well pump is switched on. Water level data shall be collected at the time intervals shown in Table 1 or as specified by the project manager. All appropriate aquifer-test data shall be recorded on the aquifer-test data record sheet (Figure 2). Each person recording data shall sign and date, in ink, his or her record sheet.

The duration of the aquifer test shall be determined by the project manager. For a valid aquifer test the recovery well should be pumped until changes in drawdown become negligible, the hydraulic gradient becomes constant and/or changes in the discharge rate from aquifer to the recovery well approach zero. These criteria determine the type of solution, steady state or non-steady state, that will be used in analyzing the aquifer-test data. The forementioned conditions indicate steady-state conditions. Steady-state conditions will allow for the most accurate evaluation of the aquifer's hydraulic characteristics.

The duration of the aquifer test can be estimated during the design phase while judgments in the field as to the state of ground-water flow can be made once data has been collected for a sufficient period of time. Aquifer tests should however be run for no less than 12 hours. A practical maximum duration of 72 hours will provide sufficient data to characterize hydraulic properties of the aquifer. Large aquifer systems which may be used for major municipal supplies should be tested for 7 to 14 days to evaluate long-term pumping affects.

The discharge rate should be measured and adjusted (if necessary) at least hourly throughout the entire aquifer test. Ground water withdrawn from the recovery well must be discharged at a suitable distance outside of the radial cone of influence. This will prevent artificial recharge back into the aquifer system. If artificial recharge into the aquifer system being tested occurs, erroneous results will be calculated during analyses of the aquifer-test data.

4.4 Recovery Phase

During the recovery phase of the aquifer test the recovery well pump is switched off and water level rebounds are measured in all monitoring wells and the recovery well at the time intervals listed in Table 1. Monitoring of the water level rebound should continue until the aquifer has recovered to within 90 percent of its initial water level. It is usually sufficient to monitor for a 24-hour period. Long-term pumping, however, should be followed by long-term monitoring of water level recovery and post-aquifer-test water level trends.

5.0 AQUIFER-TEST ANALYSES

Once the aquifer test has been completed, field data must be reduced, assimilated and evaluated. Data analyses include three main procedures:

1) Water level data must be corrected for antecedent trends observed during phase two of the aquifer test.

2) Time-drawdown data collected during the pumping phase of the aquifer test must be plotted on log-log paper. These log-log plots are then matched to known aquifer type responses shown in Figure 3.

3) Aquifer-test data must be analyzed using appropriate type solutions as listed in Tables 2 and 3.

Aquifer-test data which has been corrected for any antecedent trends is plotted on log-log paper. These plots are then matched to typical responses of known aquifer types as shown in Figure 3. Once the type of aquifer response has been evaluated, the project manager must select the proper solutional technique to evaluate the aquifer-test data. Table 2 lists the various methods of data analyses and calculated hydraulic properties which can be used if the following assumptions are met:

- The aquifer has infinite areal extent.
- The aquifer is homogeneous, isotropic and of uniform thickness.
- Prior to pumping, the piezometric surface and the phreatic surface are nearly horizontal.
- The discharge rate is constant.
- The aquifer is fully penetrated by the recovery well.
- Storage within the recovery well can be neglected.
- Water removed from the aquifer is discharged instantaneously with a decline in hydraulic head.

More detailed analyses may be necessary under complex hydrogeologic conditions. Table 3 lists techniques of aquifer-test analyses with replaced assumptions indicative of more complex hydrogeologic conditions. In any case, the assumptions on which analyses are based should be stated in the final report.

All aquifer-test analyses must be performed by a qualified hydrogeologist. The list of references at the end of this SOP provide detailed methods of analyses for all hydrogeologic conditions.

6.0 REVIEW

All data reduction, calculations and assumptions shall be verified, by a qualified person other than the originator, in accordance with SOP 2005 (Numerical Analysis and Peer Review). In addition to protocols listed in SOP 2005, the verification process shall include a review of:

- Assumptions made for antecedent water-level trends

- Major assumptions as listed in Section 5.0 for aquifer type and solutional technique
- Overall method of analyses and reporting of results

All reviews shall be signed by the reviewer prior to reporting of analyses to the client.

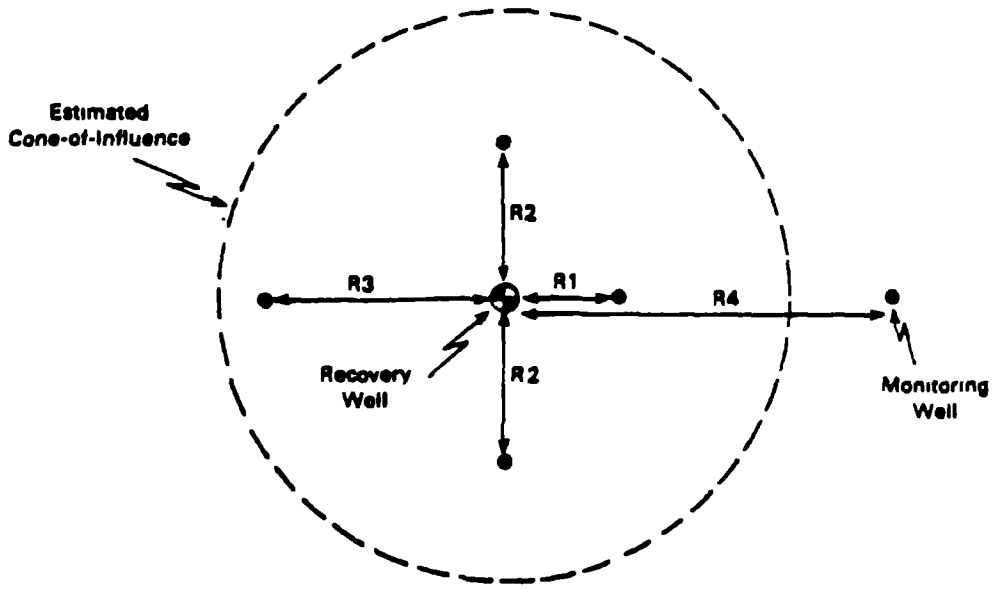
REFERENCES

Ground Water Manual, A Water Resources Technical Publication, U.S. Department of the Interior, 1977.

Ground Water; R. Allan Freeze and John A. Cherry, 1979.

Practical Aspects of Ground Water Modeling, Flow, Mass and Heat Transport, and Subsidence; Analytical and Computer Models. William C. Walton, 1984.

Analysis and Evaluation of Pumping Test Data; Bulletin 11. Kruseman G.P. and DeRidder N.A.



Where:

R = Radial Distance from the Recovery Well
and R1 < R2 < R3 < R4

Aquifer Assumptions:

- The aquifer has infinite areal extent.
- The aquifer is homogeneous, isotropic and of uniform thickness.
- Prior to pumping the piezometric surface and phreatic surface are nearly horizontal.
- The discharge rate is constant.
- The aquifer is fully penetrated by the recovery well
- The storage in the recovery well can be neglected.
- Water removed from the aquifer is discharged instantaneously with a decline in hydraulic head.

Figure 1 Generalized Aquifer Test Set Up

TABLE 1

PREDETERMINED MEASUREMENT INTERVALS

Time Since Test-Started	Measurement Interval
0 - 1 hr	1 - 5 mins
1 - 3 hrs	15 mins
3 - 5 hrs	30 mins
5 - 24 hrs	60 mins
24 - 48 hrs	2 - 4 hrs
48 - 72 hrs	4 - 8 hrs

Well # _____
Pg 1 of ____

AQUIFER TEST DATA RECORD SHEET

Date _____ Technician _____
Project _____
Depth of Well _____ Length of Screen _____
Time Test Started _____ hrs. Length of Casing (AGS) _____
Radial Distance from Pump Well _____
Static Water Level (TOC) _____

Watch Time	Time Since Test Started	Water Level from T.O.C.	Adjusted Water Level	Drawdown (ft)	Pump Rate

ERT
A RESOURCE ENGINEERING COMPANY
696 VIRGINIA ROAD CONCORD MASSACHUSETTS 01742 USA

Figure 2 Aquifer Test Data Record Sheet

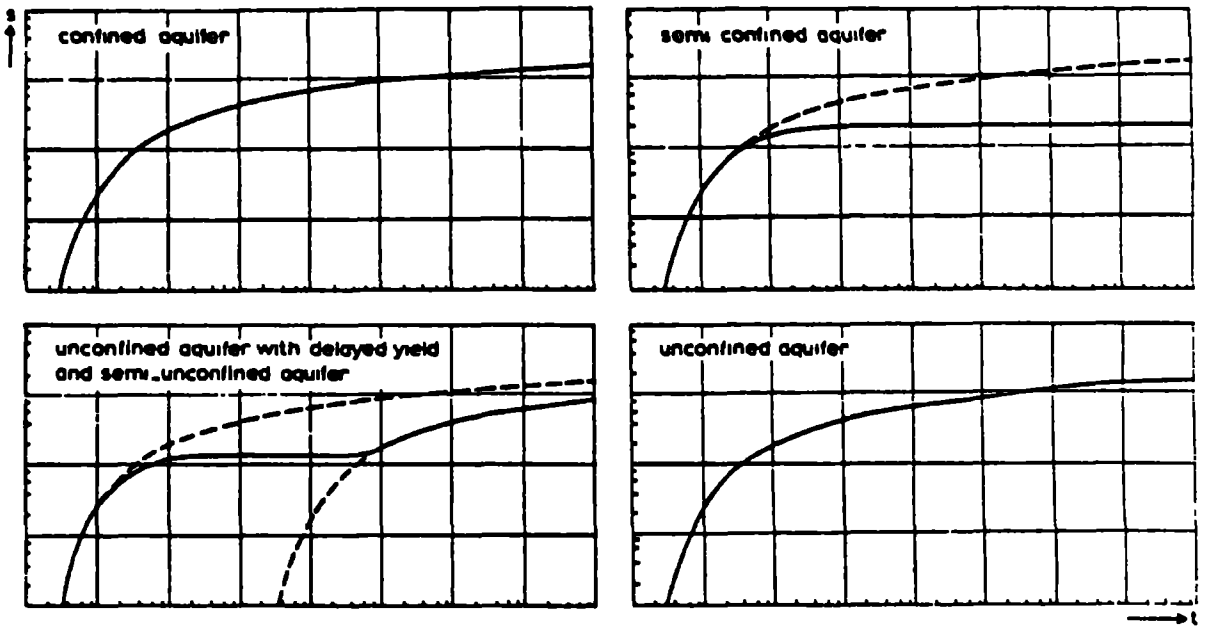


Figure 3 Typical Time-Drawdown Curves for Different Aquifer Types

TABLE 2

ANALYTICAL PROCEDURES FOR EVALUATING AQUIFER-TEST DATA

Aquifer Type	Type of Solution	Method of Analysis		Calculated Parameters*
		Name	Type	
confined	steady state	Thiem	calculation	T,K
	unsteady state	Theis	curve fitting	T,S,K
		Chow	nomogram	
		Jacob	straight line	T,S,K
		Theis recovery	straight line	T,K
semi confined	steady state	De Glee	curve fitting	T,C,K,L
		Hantush Jacob	straight line	T,C,K,L
		Ernst mod. Thiem meth.	calculation	T,K
	unsteady state	Walton	curve fitting	T,S,K,C,L
		Hantush I	inflection point	T,S,K,C,L
		Hantush II	inflection point	
		Hantush III	curve fitting	T,S,K,C,L
unconfined with delayed yield and semi-unconfined	unsteady state	Boulton	curve fitting	T,S_A,S_Y,B,1/α,K
unconfined	steady state	Thiem-Dupuit	calculation	T,K
unsteady state	as for confined aquifers			T,S,K

Note: T = Transmissivity; K = Horizontal Hydraulic Conductivity; S = Storativity; C = Hydraulic Resistance; L = Leakage Factor; S_A = Storativity; S_Y = Specific Yield; 1/α = Delay Index; B = Drainage Factor

TABLE 3

ANALYTICAL PROCEDURES FOR EVALUATING AQUIFER-TEST DATA

Replaced Assumption(s)	Aquifer Type	Type of Solution	Method of Analysis: Name	Method of Analysis: Type	Conditions	Calculated Parameters*
Aquifer crossed by one or more fully penetrating recharge or barrier boundaries	confined or unconfined	steady state	Dietz	calculation	recharge boundaries only	T,K
		unsteady state	Stallman	curve fitting	recharge and/or barrier boundaries	T,K,S
			Hantush image	straight-line	one recharge boundary	
Aquifer homogeneous, anisotropic and of uniform thickness	confined or unconfined	unsteady state	Hantush	calculation		T_X,T_Y,S,K
			Hantush-Thomas	calculation	for recovery data also	T_X,T_Y,S,K
	semi confined	unsteady state	Hantush	calculation		T_X,T_Y,S,C,L,K
Aquifer homogeneous and isotropic; but thickness varies exponentially	confined	unsteady state	Hantush	curve fitting	dD/dx < 0 20	T,S,K
Prior to pumping the phreatic surface slopes in the direction of flow	unconfined	steady state	Culmination point	calculation		T,K
		unsteady state	Hantush	curve fitting	i < 0.20	T,S,K
Discharge rate variable	confined or unconfined	unsteady state	Cooper-Jacob	straight line	step-type pumping	T,K,S
			Aron-Scott	straight line	continuously decreasing discharge	T,K,S
			Sternberg	straight line	continuously decreasing discharge	T,K,S
			Sternberg recovery	straight line	continuously decreasing discharge	T,K

Note. T = Transmissivity; K = Horizontal Hydraulic Conductivity; S = Storativity; C = Hydraulic Resistance, L = Leakage Factor; T_X,T_Y = Transmissivity in the X and Y direction.

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APPENDIX C

CONTRACT SPECIFICATIONS

CONTRACT SPECIFICATIONS

FOR

DRIFT AND PLATTEVILLE AQUIFERS

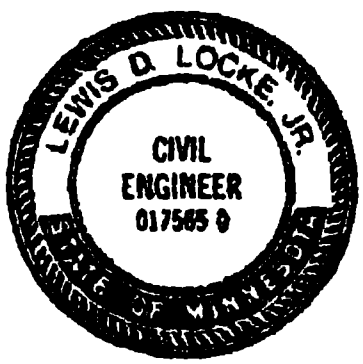
GRADIENT CONTROL WELL

REILLY TAR & CHEMICAL CORP.

1510 MARKET SQUARE CENTER

151 NORTH DELAWARE STREET

INDIANAPOLIS, IN 46204



I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Lewis D. Locke, Jr.

Date OCT 31 1986 Reg. No. 017565 0

PUMPING FACILITY ENGINEERING SPECIFICATIONS

CONTENTS

SECTION 100

SUMMARY OF WORK

101 SCOPE OF WORK

The work consists of the complete finish of the Drift and Platteville aquifers gradient control Pump House at _____W. Oxford St., St. Louis Park, MN. The work is to be completed as per this specification and Reilly Tar & Chemical Corp. drawings 861737-001, 300 and 602.

102 OWNER RESPONSIBILITIES

The Owner will have a Representative available for field Consultation.

The Owner will furnish site elevations prior to letting the work for bids.

The Owner will furnish all required construction and permanent permits.

103 CONTRACTOR RESPONSIBILITIES

The Contractor will supply the Owner with a schedule of construction before the work begins and with a revised and updated schedule weekly as the work progresses.

The Contractor will arrange for a temporary water supply and temporary electrical service connection during the construction period.

The Contractor shall provide project management to ensure completion of the work on schedule.

The Contractor will be responsible for base lines and bench marks for subcontractor use.

The Contractor must notify the Owner 3 days in advance of any utility tie-in or any work that will interrupt normal activity around the job site.

Coordination between the Contractor and the Subcontractors must be maintained in order to meet the schedule.

All applicable Codes and Safety Regulations will be followed by every Contractor and his workers.

The Contractor shall provide five copies of all equipment warranties, operating instructions, installation instructions, maintenance instructions and parts list for each piece of equipment installed shall be provided to the owner on completion of the work.

The Contractor shall provide temporary baricades and fencing.

The Contractor shall ensure that at the end of each working day, positive drainage shall be provided.

The Contractor shall ensure that the topsoil is removed to its entire depth, in the areas of new construction and stockpile topsoil which will be required for finish grading.

The Contractor shall see that areas that are to have topsoil removed shall first be cleared of excessive vegetation, rubbish and debris.

The Contractor shall see that stockpiled topsoil is replaced in lawn areas prior to sodding and or seeding to a minimum depth of 6 inches. Remove all stones larger than 2 inches.

The Contractor will be responsible for site restoration to near original condition. Sod shall be placed where necessary to return site to original conditions or prevent erosion otherwise graded areas shall be seeded.

The Contractor shall be responsible for layout of his Work, including lines and elevations. Each Subcontractor shall field verify all dimension relating to his work, as shown on the Drawings, and report any errors or discrepancies to the General Contractor before commencing work.

The Contractor is responsible for the protection of his Work from adverse weather. He shall provide, at all times, all means and methods for weather protection as necessary for the satisfactory execution and performance of his work.

104 GUARANTEES

A written one year guarantee is required to cover all installed material, equipment and labor not otherwise covered by manufacturers warranties. Exceptions to this are the roof (2 yrs) and caulking (5 yrs).

All guarantees will begin at the Owners recognized date of substantial completion.

105 TEMPORARY FACILITIES

The Contractor will furnish a project office at the site with a telephone for business use to all personnel. Toilet facilities will be provided by the Contractor.

Storage facilities are to be provided by the Contractor. Set-up location must be approved by the Owner. If the set-up location interferes with work later in the job, relocation may be required.

The Electrical Subcontractor will furnish all temporary electrical for lights and outlets at the beginning of the job. This temporary work is to be included in the Contract Bid. This work must meet the appropriate codes and regulations.

The Electrical Subcontractor is also responsible for removal of this equipment when no longer needed.

Fire extinguishers will be provided by the Contractor at required locations on the job site. Each Subcontractor is responsible for providing his own extinguishers during any cutting or welding. Certain Owner designated locations will require Owner approval before welding or cutting can be done.

Project Sign: If required, the Contractor will provide and maintain a Project Sign as approved by the City and the Owner. No other signs are allowed except as required for safety, security, or traffic control; or without the permission of the Contractor.

106 MEETINGS

Prior to Contract award, the leading Bidder will be required to attend a pre-award meeting. At this time the bid and all applicable Contract

Document information will be reviewed. A preliminary schedule will be provided for Contractor input. The Contractor should also be ready to provide information on Subcontractors, Suppliers, material and equipment delivery times, personnel etc.

At any time during the job, the Owner may call a progress meeting in the St. Louis Park area. These meetings may require attendence by the Contractor, Subcontractors and Material Suppliers.

107 SHOP DRAWINGS

Shop drawings and product data must be received by the Owner with sufficient time for approval. Contractor or Supplier delay in forwarding drawings and data for approval will not be viewed as an acceptable reason for schedule extension.

Seven (7) copies of all approved drawings and data will be supplied to the Owner for further distribution.

108 CLEAN-UP

The Contractor and each Subcontractor will be responsible for site clean-up during the job. A trash container will be supplied by the Contractor.

109 PROJECT CLOSEOUT

The Mechanical and Electrical Subcontractors must submit five (5) sets of operating and maintenance manuals to the Owner before final payment will be made. These manuals will contain the following:

- Contractor and Supplier List
- Guarantees
- Wiring and control diagrams
- Operating instructions
- Maintenance instructions
- Parts lists
- Any other information relating to supplied equipment and materials

The Contractor and all Subcontractors must submit a Contractor and Supplier List and a written guaranty.

The Contractor will be responsible for keeping a set of as-built drawings on site for updating changes. It is the responsibility of each Subcontractor to note all changes related to his work on this set.

SECTION 200

MECHANICAL WORK

201 GENERAL

This Section describes work, equipment and materials to be furnished by the Mechanical Subcontractor.

All mechanical systems are to be finished to a ready-to-operate condition. The Mechanical Contractor is responsible for completing all mechanical systems except for power wiring tie-ins.

The accompanying drawings have been drawn to scale and have some listed dimensions. Care has been taken to maintain accuracy, but it remains the Contractors responsibility to verify the scaled and listed dimensions.

The Mechanical Subcontractors Bid shall include a list describing the major types of equipment and materials to be used. After acceptance of the bid, changes to this list will not be allowed.

The Mechanical Contractor will assume all responsibility for conforming to rules and regulations of the applicable government agencies and utilties.

The plumbing installation will comply with all requirements of the Minnesota Department of Health and the Uniform Plumbing code.

The mechanical installation will comply with the Uniform Mechanical Code.

All installed work will comply with rules and recommendations of the National Fire Protection Association.

Shop drawings and operation and maintenance manuals must be supplied as described in the SUMMARY OF WORK.

202 SYSTEM TESTING

Every piping system will be flushed clean prior to pressure testing.

Testing procedures for all piping systems are as follows:

Air Test: The air test shall be made by attaching an air compressor testing apparatus to any suitable opening, and, after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 pounds per square inch (5 psi/34.47 kPa) or sufficient to balance a column of mercury 10 inches (254 mm) in height. This pressure shall be held without introduction of additional air for a period of at least 15 minutes.

203 MECHANICAL EQUIPMENT SPECIFICATIONS

Discharge Gate Valve 2" flgd (Powell Fig. 515)

Pressure Gauges (2) 0-100 psi (Ashcroft 1279 (*) 54 1/2"
TA Lower 1/2 NPT 0-100 psi)

Flow Controller 2" flgd (Kates Flow Control KB11F-CDG)

Sample Line Valve and Pressure Gauge Shutoff Valves
1/2" NPT, ball type (Powell Fig. 4210B 1/2")

Flow Meter 2" NPT (Hersey Turbine Meter MVR160-C-I-200-P-G-C with 1005 pulse to DC converter, manufacturers calibration records are required for these devises)

Backflow Check Valve 2", spring closing (TRW Mission Duo Check II K15 HMF 2")

Reduced pressure backflow preventer 2" NPT (FEBCO 825Y with gate valves.)

204 GENERAL PIPING MATERIALS

The Mechanical Contractor is to furnish all piping, valves and accessories to complete the work as described by the Contract Documents. Substitutions may be made for specified items with approval from the owner.

The list of acceptable manufacturers is as follows:

- Gate and check valves: Nibco/Scott, Crane, Powell, Lunken, TRW Mission Heimer, Walworth, Jenkins or Stockman

- Ball valves: Wolverine Brass Works, Nibco/Scott, Hammond, Powell, Jamesbury, Metraflex or Dyna-Quip

All flange connections are to have 1/16" full face "Cranite" gaskets coated with a thread lubricant when installed.

205 GENERAL PIPING INSTALLATION

All piping must be installed and routed in a neat and orderly manner with sufficient clearances for maintenance unless otherwise indicated on the drawings.

206 GAUGES

Acceptable guage manufacturers are Ashcroft, Marsh, Trerice, Duro, Danton, Cambridge, American Air Filter or Dryer.

Typical guages shall be similar to the following:

- Ashcroft 1279

207 DISCHARGE WATER PIPING

Piping will be part low carbon steel galvanized Sch 40 ASTM A120/A53 with screwed and flanged fittings and part polyethylene coated carbon steel Sch 40 ASTM A120/A53 as indicated on the drawings.

208 DRAIN PIPING

Piping will be part no hub cast iron ASA Group 022, ASTM A74, ANSI A112.5.13, ASTM C564 gasket sleeves, CISPI 310 couplings and part polyethylene coated carbon steel Sch 40 ASTM A120/A53 as indicated on the drawings.

209 GENERAL EQUIPMENT INFORMATION

The Mechanical Subcontractor is responsible for complete purchasing and installation of all equipment other than as noted in the Drawings and

Specifications. This work includes supports and all connections except power wiring to the unit.

All equipment is to be completely installed to a ready to operate state, including any lubrication, alignment and adjustments.

SECTION 300

ELECTRICAL WORK

301 GENERAL

This section describes work, equipment and materials to be furnished by the Electrical Subcontractor.

The Electrical Subcontractor will assume all responsibility for conforming to all rules and regulations of the applicable government agencies and utilities.

The Electrical Subcontractor is responsible for verification of dimensions that affect his work. Any minor deviations caused by interferences shall be considered a part of the job and the owner will not be held responsible for any reimbursement.

All electrical equipment must be U. L. approved and meet all other applicable code requirements.

All permits and inspections required for completion of electrical work are to be arranged and paid for by the Owner.

All electrical materials and equipment shown on the Contract Drawing and listed in the Specifications must be provided by the Electrical Subcontractor unless otherwise noted.

Shop Drawings and Operations and Maintenance Manuals must be supplied as described in the SUMMARY OF WORK.

302 TEMPORARY WORK

The Electrical Subcontractor must supply temporary power supply pole and outlets to allow for convenient construction use.

303 ELECTRICAL EQUIPMENT SPECIFICATIONS:

Pump 5 Hp, 3ph, 200V, 60Hz, 17 amps (furnished by Well Contractor)

Nema Size 1 starter (Square D class 8536, type SCW, Nema type 4 with Dual Push Button and pilot light control unit KXRG117, fused 120V control transformer & extra contact)
Hourmeter non reset type (Redington 7526-002)
One 50 amp circuit breaker disconnect in load center (Square D Q0350) 3 pole, common trip with indicator

Heater 5KW, 17,065 Btuh, 208 V, 3 ph, 60Hz, 14 amps (Emerson-Chromalox MUH-05-8 unit heater, MT-1 thermostat, MMB-5 mounting bracket)
One 20 amp circuit breaker disconnect in load center (Square D Q0320)3 pole, common trip with indicator

Lights 2 units each unit having 2 lamps, 120V, 6Hz, 70 watts per fixture, .65 amps per fixture (Graybar Meter Miser Wrap-Arounds GMM-8-2224)
One 15 amp ground fault circuit interrupter circuit breaker disconnect in load center for both lights (Square D Q0115GFI) 1 pole with trip indicator

Switch toggle type, 120V, 15 amp (Hubbell 1201 GRY)

Recorder/Totalizer (Chessell Model 390-12-010-10-100 11000 0, manufacturers calibration records are required for this devise)
One 15 amp ground fault interrupter circuit breaker disconnect in load center (square D Q0115GFI) 1 pole with trip indicator

Duplex Outlet corrosion resistant, 3 wire grounding, 125V 20 amp (Hubbell 53CM62)
One 20 amp ground fault circuit interrupter circuit breaker disconnect in load center (Square D Q0120GFI) 1 pole with trip indicator

Loadcenter circuit breaker type, 3ph, 4 wire, 120/208V AC WYE, 100 amp main (Square D Q0424M100) flush cover (Square D QOC430LF) Equipment Ground bar kit (Square D PK15GTA)

Safety Socket Box test-bypass type, 3ph, 4 wire, 208Y/120V, 100 amp (Square D EM71NRB)

304 GENERAL MATERIALS

The following types of material and equipment should be used

- Service equipment, panelboards, safety switches, motor starters and other general purpose control devices	- Square D
- Wiring devices	- Hubbell, A.H. & H., P. & S. G. E., Sierra, Grouse-Hinds
- Finishing plates	- Sierra
- Lighting Fixtures	- Noted on Drawings or approved equal
- Lamps	- G.E., Sylvania or Westinghouse

Conduit can be U.L. approved heavy wall rigid or EMT where not otherwise specified. All fittings must be U.L. approved and electrically conductive. Minimum conduit size is 3/4" except where noted. Flexible conduit is 1/2" minimum.

Conduit runs shall be in the block walls and under the concrete floors unless otherwise indicated.

Wire and cable for general wiring shall be rated 600 volt. Conductors size #12 through #8 AWG shall have type THW or THWN insulating wall unless otherwise noted. Conductors sized #6 AWG and larger shall have type XHHW insulating wall unless otherwise noted. Minimum conductor size must be #12 AWG. All wire terminating in light fixtures or at equipment should be heat resisting type. Wire must be sized so that voltage drop does not exceed 3% from branch panel to last outlet. Color coding should be Phase A - Black, Phase B - Red, Phase C - Blue, Neutral - White or Grey and Ground - Green. All wire must be 98% conductability soft drawn commercially pure copper.

Toggle switches and receptacles should have a grey finish. Finishing plates must be brushed stainless steel.

305 GENERAL INSTALLATION

The Electrical Subcontractor is responsible for all power tie-ins required for installed equipment.

All equipment, switches, panels, main circuits and feeder circuits that are installed by the Electrical Subcontractor should be identified by permanent labels.

The Electrical Subcontractor is responsible for all testing required to insure a complete and secure electrical system.

All conduit shall be hidden from view unless noted on drawings or approved by Owner. No runs will be installed diagonally. Conduit ran through outside walls must be sealed with appropriate material.

Wire must not be pulled using grease or oil. Only cable pulling compounds similar to Y - ER - EASE are to be used. Any required splicing will be done using approved splicing procedures and must be approved by Owner.

All wall mounted switch and outlet boxes must be flush mounted unless otherwise noted.

Mounting height of switch and outlet boxes and devices are to be as follow:

- Receptacle outlets - 40" above floor
- Toggle switches - 48" above floor

306 HEATER

The Electrical Subcontractor is responsible to furnish, install and wire the electric heater. The heating fixture is to be hung from the wall after the wall and ceiling painting are complete. The unit specified may be replaced with an equal unit. Such a unit shall have a built in thermostat (40° to 85°F range), totally enclosed corrosion resistant elements finned and sheathed, quiet built in fan, totally enclosed motor with sealed bearings automatic-reset thermal cut-out disconnects for element and motor.

307 PANEL BOARD, STARTER AND METER BOX

100 amp, 3ph, 4 wire, 208Y/120 volt meter box is to be supplied and installed by the Electrical Subcontractor, the unit is to be equal to Square D.

Nema Size 1 starter is to be supplied and installed by the Electrical Subcontractor. The unit is to be equal to Square D. It is to be installed after the wall and ceiling painting are complete.

100 amp 120/208 volt circuit breaker panelboard complete with main breaker and listed number of individual breakers is to be supplied and installed by the Electrical Subcontractor. The panel should be equal to Square D.

308 GROUNDING

The conduit system ground must be continuous through all new construction. All equipment must be provided with a suitable ground. Green pigtails and jumpers are to be used with outlets, switches and all flexible conduits. All conduit ground must be tested to insure correct and complete ground and approved by Owner.

309 LIGHTING

The Electrical Subcontractor is responsible to furnish, install and wire all light fixtures. Ceiling fixtures will be hung after ceiling is painted. All ceiling fixtures must be self supporting and also secured to bar joists. All fixtures must be equipped with U. L. heat resistant wiring. Fixtures should have white finish on all metal.

310 SERVICE ENTRANCE WIRING

The service entrance wire size will be #2 AWG. The service entrance conduit will be routed underground to the nearest Power Company pole or ground mounted transformer. The bury depth shall be 18 inches to the center of the conduit. A 2 inch thick by 6 inch wide concrete cover shall be poured in the trench after 6 inches of fill has been compacted over the conduit. A yellow plastic warning tape shall be laid in the trench after 6 inches of soil has been compacted over the concrete cover. The remaining fill shall then be added and compacted. If a ground mounted transformer is to be utilized for the power supply the service entrance conduit shall terminate in the terminal cabinet of the transformer. If a pole mounted transformer is to be utilized for the power supply the service entrance conduit shall extend 12 feet up the pole and have a weather head. The General Contractor will be responsible for coordinating the electrical service connection.

SECTION 400

PAINTING

401 GENERAL

The Painting Subcontractor is responsible to furnish all supplies and labor to paint all interior walls, ceiling, door (interior and exterior), gutters, downspouts, exposed roof flashing, meter box and exposed conduit.

The painting schedule will consist of two segments. All sealing, priming and finish coats will be in the first segment. After other construction is complete touch up will be done.

Care must be taken to protect all adjacent surfaces during preparation and painting. All surfaces should be prepared to paint manufacturers recommendations before painting.

402 MATERIALS AND APPLICATION

Top Coat Paint colors to be used are as follows:

- All exterior metal doors, frames and meter socket box	- Glidden Professional Colors Aluminum
- All galvanized gutters, flushing, downspouts and conduit	- Glidden Professional Colors Aluminum
- All interior walls, ceilings, doors frames and conduit	- Glidden Professional Colors White

Paint types to be used are as follows:

- Exterior Primed Surfaces	- (2) coats Glidden #592
- Exterior Galvanized Surfaces	- (2) coats Glidden Epoxy Chromate Primer #5251/5252 - (2) coats Glidden #592
- Interior Block	- (1) coat Glidden Ultra Hide Block Filler #5317 - (2) coats Glidden Glid Guard Epoxy #5250/5242
- Interior Ceiling, bar joists and conduit (all galvanized)	- (2) coats Glidden Epoxy Chromate Primer #5251/5252 - (2) coats Glidden Glid Guard Epoxy #5250/5242
- Interior Primed metal door and frame	- (1) coat Glidden Universal Fast Dry Metal Primer #5210 - (2) Coats Glidden Glid Guard Epoxy #5250/5242

SECTION 500

ENTRY WALK

501 GENERAL

The Paving Subcontractor is responsible for labor, material and installation of the entry walk shown on Reilly Tar & Chemical Corp. drawing number 861737-602.

All concrete shall be cured for a period of not less than 7 days. During this curing period, no part of the concrete shall be permitted to become dry. Curing shall be applied and maintained to prevent loss of water from concrete for the duration of the curing period.

Fresh concrete shall be protected from heavy rains, flowing water and mechanical injury. All concrete shall be protected from the sun and drying winds.

Sidewalks and other exterior slabs except vehicular traffic areas shall receive a hair broom finish in accordance with ACI 301, Section 1104(d) with a Class B. tolerance.

Exterior concrete slabs shall be cured with Sealtight WP-40 White-Pigmented Concrete Curing Compound as manufactured by W. R. Meadows Elgin, Illinois. or an equal product approved by the Owner. Application for this product shall be 300 square feet per gallon. Product shall meet specifications: ASTM C309, Type 2, Class A; AASHTO M148, Type 2, Class A; ANSI A 37.87, Type 2, Class A.

Concrete testing shall be done on a per truckload basis. Samples shall be taken per ASTM methods and tested by an independent testing laboratory. The laboratory shall be selected by the General contractor and approved by the Owner. The cost of sampling and testing shall be included in the bid price. The owner will evaluate the test results for acceptance or rejection.

SECTION 600

BUILDING

601 GENERAL

This portion of the contract includes the following:

- Foundation construction
- Masonry wall construction
- Wall, roof and floor insullation
- Concrete floor construction
- Brick veneer construction
- Bar joists and decking construction
- Roof scuttle
- Roofing, flashing, nailers, gutters and downspouts
- Door, frame, threshold, hinges, plates and handle
- Lockwork and door closer
- Caulking

All materials and labor required for complete finish are to be included.

All of the Work shall meet the requirement of all governing codes, ordinances, laws, regulations, safety orders and directives.

602 EXCAVATION AND BACKFILL

Provide all equipment, material and labor to excavate for foundations, footings, stoops, sidewalks, curbs, retaining walls and similar items, all to the lines and grades indicated herein and on the drawings.

Excavate to full depth and full width of foundations; allow ample room for forms where required. Excavation shall be held to a true line and grade. Bottom shall be level and free from loose material. Where bottom of footing is undercut, return to grade with concrete of same quality as specified for the footing of foundation.

Promptly backfill excavations as work permits, but not before walls have attained design strength. Shore walls and footings as required to prevent toppling, cracking, and misalignment.

All spaces excavated for and not occupied by structures shall be backfilled to subgrade with excavated materials from the site or bank-run gravel from off-site and thoroughly compacted in layers not to exceed 12" in depth. Backfill shall be compacted to a minimum of 95% of maximum density at optimum moisture content, as determined by Modified Proctor Test (ASTM D-1557). Backfill simultaneously on both sides of the structures.

Excess excavated material not used as backfill, but suitable for site fill, shall be used for site grading as directed by the Contractor.

Excavated material deemed unsuitable for backfilling or fill will be disposed of by the Owner.

Fill material required to complete the finish grading will be bank-run gravel for subgrade and top soil as required to meet the minimum coverage requirement of 6 inches. All additional materials for the building excavation and general site grading shall be provided by the Contractor.

Place granular drainage fill under the slab and compact. Depth of drainage fill shall be minimum 6 inches or as shown on drawings.

Earthwork density tests shall be required for each lift during construction. They shall be made by an independent testing laboratory selected by the Earthwork Subcontractor and approved by the Owner. Field density tests shall be taken at locations selected with a minimum of one per 150 sq. ft. per 2' lift. All tests required to bring compaction to the required density shall be paid for by the Building Earthwork Subcontractor.

603 CONCRETE

This section includes general requirements for the concrete Subcontractor and is intended to supplement the specifications listed on the drawings.

Reinforcing bars shall conform to the requirements of ASTM A-615 "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement. The grade of steel to be as shown on drawings.

Welded wire fabric shall conform to the requirements of ASTM A-185, "Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement".

Expansion Material shall be ASTM D1752, Type III, preformed, self-expanding strips formed of cork particles with a nonbitumen, isolable resin binder, similar to "W.R. Grace Code No. 4324."

Vapor barrier material shall be 6 mil polyethylene ASTME-96.

All materials and labor required for complete finish are to be included.

All of the Work shall meet the requirement of all governing codes, ordinances, laws, regulations, safety orders and directives.

Provide Expansion Joint Material where indicated on Drawings. Install preformed, self-extending granulated cork strips full depth of joints.

Interior concrete slabs shall be cured with Clear Bond as manufactured by Guardian Chemical Company, Atlanta, Georgia or approved equal by the Owner that can be applied in one coat at the rate of 400 square feet to the gallon and shall meet ASTM C309 (Type 1), TTC-00800 (GSA-Fss), CRD-C-300 and U.S. Corps of Engineers Abrasion Test Method.

Preparation: All work shall be in accordance with ACI-614-59, "Recommended Practice for Measuring, Mixing and Placing Concrete". ACI-614-59 will be republished as ACI-304. All construction debris and extraneous matter shall be removed from within the forms. Struts, stays, bracing and blocks, servicing temporarily to hold the forms in correct shape and alignment, shall be removed. All concrete shall be place on clean damp surfaces, free from water, or upon properly consolidated fills.

Vibration: Concrete shall be consolidated by means of mechanical vibrating. Vibrators shall be inserted and removed vertically at regular intervals to insure uniform consolidation. In no case shall vibrators be used to transport concrete inside the forms. Internal vibrators shall maintain a speed of not less than 7,000 impulses per minute when in operation. At least one standby vibrator shall be on hand at all times.

Cold Weather Batching: No frozen materials or materials containing ice shall be used in cold weather. Temperatures of materials including mixing water, shall not exceed 140°. When placed in forms, the concrete shall have a temperature between 50°F. and 90°F. Work shall be in accordance with ACI-306, "Recommended Practice for Winter Concreting".

Top surface of footings shall receive a floated finish with a Class B tolerance (1/4 inch in 10 feet).

All interior floor slabs shall receive a troweled finish in accordance with ACI 301, Section 1104(c) with a Class A tolerance (1/8 inch in 10 feet).

All concrete shall be cured for a period of not less than 7 days. During this curing period, no part of the concrete shall be permitted to become dry. Curing shall be applied and maintained to prevent loss of water from concrete for the duration of the curing period.

Fresh concrete shall be protected from heavy rains, flowing water and mechanical injury. All concrete shall be protected from the sun and drying winds.

604 HARDWARE SPECIFICATIONS

Door Lockset (To match existing City Utility Dept. Facilities and keyed alike)

Roof Scuttle Pad Lock (Master, keyed to City Utility Dept. System)

Door Closer (Yale Series 50, standard door closer #54)

Door Hinges (3) Full Mortise, standard weight, wrought steel, Anti-friction ball bearing, non rising pin, flush tip, Non-Removable Pins, Satin Chrome finish (Stanley FBB179-26D-NRP)

Roof Scuttle (Bilco Type S-50)

605 MASONRY WALL CONSTRUCTION

The door opening shown on the drawing is to have a reinforced lintel. Construction materials should be 6" & 12" ASTM C90, Grade N, Type 1 hollow core block and Type S mortar.

Face brick shall be standard size (2-1/4" x 3-3/4" x 8"), grade SW, conforming to ASTM designation C216. Color and style to be specified by the Owner.

Wall reinforcing shall be truss type, 9 gauge steel wire conforming to ASTM A82, with side rods deformed. Placed as shown on drawings. Standards: Truss-Mesh (Hohmann & Barnard) - Dur-O-Wall (Dur-O-Wall Mfg. Co.) - Keywall Truss (Keystone).

Mortar joints which are to be exposed or painted shall be struck off flush with the wall surface and when the mortar is partially set, shall be firmly compacted with a round jointing tool. Mortar joints in the face of walls to be covered shall be struck off flush with the face of the wall.

The Masonry Subcontractor shall cooperate with all trades and be responsible for cutting, patching and building-in all work as required.

The door frame is to be grouted

Set and build-in flashings and counter flashings, expansion joints, frames, sleeves, lintels, and anchor inserts, furnished under other Sections, which are incidental to, or support masonry.

Anchors embedded in masonry shall be furnished and installed by the Masonry Contractor. Size and spacing will be shown on drawings.

Flashing, expansion and control joints shall be built-in to masonry and placed as the work progresses. Provide weep holes 24" o.c. at bottom of walls (floor line) and bottom of flashings.

Exterior brick and stone walls above grade shall receive silicone or stearate water-repellent, applied in accordance with manufacturer's instructions. Standards: Toch Brothers - Supertox; Sonneborn S-X Hycon; Toch Brothers Limestone Supertox; Sonneborn Hydrocide Unipel.

All permanently exposed masonry walls, including partitions shall be thoroughly cleaned down on completion, damaged surfaces repaired or replaced and mortar joints pointed to leave the work in a condition acceptable to the Owner. Cleaning and pointing shall be started at the top and worked down. Cleaning of MASONRY, except concrete block and stone, shall be done with fiber brushes using soap powder boiled in water, adding clean, sharp, fine sand to the soap and water mixture where necessary. Excess MORTAR STAINS shall be removed and the entire surfaces rinsed with clean water. Cut out defective mortar joints where necessary and fill the crevices solidly with motar and tool as specified. EXPOSED CONCRETE BLOCK to be rubbed with stone to eliminate excess mortar. Point up all surfaces and leave walls in a condition acceptable to the Owner.

No masonry work shall be permitted when the temperature is less than 32 degrees F. or below 40 degrees F. and falling, unless the following precautions are taken:

1. Below 40 degrees F. but above 32 degrees F.: Heat mortar mixing water, but not above 160 degrees F. Plastic sheets or tarpaulins shall be placed over the newly laid walls.

2. Below freezing, but above 0 degrees F.: In addition to the preceding requirements, sand shall be heated, but not scorched. The working area shall be enclosed with protective coverings and artificial heat shall be provided. When the temperature falls below 20 degrees F., all concrete masonry units shall be heated to at least 50 degrees F. at the job site by the Contractor.

3. Below 0 degrees F.: Construction shall be stopped unless the enclosure is complete and tight. Observe all preceding requirements.

   Masonry shall be protected against freezing for at least 48 hours.

   No masonry shall be laid with or on frozen materials.

606 SUPPLY AND INSTALL DOOR

Hollow metal door and frame are to be supplied and installed. Doors are to be Steelcraft Corp. or approved equal. Door and frame are to be factory primed. Frame is to be grouted. The door is to be fitted with a top cap.

The frame is to be checked for level during construction to assure it remains plumb.

Finish hardware shall be equal to the following:

- Hinges	- Hager, Stanley, McKinney
- Door closer	- Sargent & Co., Yale
- Threshold	- National Guards Products Co.
- Butts	- The Stanley Works

607 SUPPLY AND INSTALL LOCKWORK

The lockwork to be used is as follows:

- Door	- To match existing city installations
- Roof Scuttle	- Master, pad lock

All lockwork except pad lock is to be satin chrome and be keyed to meet City of St. Louis Park specifications.

608 CAULKING

Provide all labor, materials, and equipment necessary for complete caulking work as shown on drawings and specified herein.

All caulking work shall be performed by an experienced, competent Caulking Contractor as per requirements herein.

Interior Caulking: same as exterior.

Exterior Caulking: shall be of a color to closely match the mortar color, 2 part polysulfide base (Thiokol) sealant material meeting requirement of American Standard Specifications for Sealing Compounds for the Building Trade, A116.1 1960 of Shore A or approved equal.

Primer: colorless by caulking manufacturer.

All materials shall be used in accordance with their manufacturer's latest printed instructions.

Caulk expansion joints, control joints, and around entire perimenter of doors and other openings and joints where caulking is otherwise indicated or obviously required on exterior of building(s).

Mix compounds which require field mixing as per manufacturer's instructions. Apply with gun especially for compound, to attain a smooth finish surface, free of wrinkles, air pockets and holes. Compress into joint with tooling rods or paddles to insure conformance of compound to even the smallest surface irregularity. Depth of joint shall be as recommended by Manufacturer of the sealant material. Pack joints required with sealant backer to bring voids to required depth before caulking.

SECTION 700

DISCHARGE PIPE AND GRAVITY DRAIN

701 GENERAL

This Section describes work, equipment and materials to be furnished by the Sewer Subcontractor.

All sewer systems are to be finished to a ready-to-operate condition. The Sewer and Manhole Subcontractor is responsible for completing all sewer systems except for pump discharge and floor drain piping installed under the building foundation and slab.

The accompanying drawings have been drawn close to scale and have some listed dimensions. Care has been taken to maintain accuracy, but it remains the Contractor's responsibility to verify the scaled and listed dimensions.

The Sewer and Manhole Subcontractor bid shall include a list describing the major types of equipment and materials to be used. After acceptance of the bid, changes to this list will not be allowed.

The Sewer and Manhole Subcontractor will assume all responsibility for conforming to rules and regulations of the applicable government agencies and utilities.

The Sewer installation will comply with all specifications of the City of St. Louis Park. All piping that is not installed to a depth of 7.5 ft. shall have a covering of 2 inches of polyurethane insulation covered with a polyethylene jacket.

The invert elevations of the discharge and drain pipes are to be a minimum of 4 feet 6 inches below grade.

Excavations shall meet local and state safety regulations as applicable.

Backfilling is to be done to the specifications of the City of St. Louis Park.

Elevation and layout drawings will be provided to the City by the Sewer Subcontractor.

All construction permits will be obtained by the owner.

702 LAYING OF PIPE

All pipe shall be laid on undisturbed earth. If earth is disturbed or soft the loose earth should be cleared out and replaced with compacted gravel.

703 DRAINAGE AND SEWAGE CONTROL

The Subcontractor shall remove by well points, pumping, bailing, or other acceptable method any water which may accumulate or be found in the trenches or other excavations to be made. He shall take all necessary precautions to keep the trenches and other excavations entirely clear of water during construction of sewers and structures. Newly laid concrete shall be adequately protected from injury resulting from ground water or sewage or from the handling or disposal of water or sewage. No drainage ditches shall be placed within the area to be occupied by any structure except as permitted by the Contractor. Upon completion of new construction, existing sewers shall be restored or otherwise provided with adequate outlets. Permits will be obtained by the owner if necessary.

The Subcontractor shall at all times have upon the job sufficient pumping equipment ready for immediate use to carry out the intent of this section.

This Subcontractor shall at no time permit effluent contaminated by raw sewage to enter any storm sewer or open ditch.

Where existing sewers or drains are encountered in this work, adequate provisions shall be made for diverting the flow in the existing sewers so that the excavation will be kept dry during the progress of the construction work. Upon the completion of the construction work, the existing sewers shall be restored or otherwise provided with an adequate outlet as directed by the Owner.

704 BACK FILLING

As soon as practicable after the pipes or conduits are constructed and inspected, the trench shall be backfilled. At the sides and top from the subgrade to a level at least one foot above the top of the pipe, selected granular material shall be deposited and carefully compacted by hand or machine tamping or water flushing in layers not to exceed six inches in depth.

In undeveloped property the backfilling shall be completed using the available excavated material, free from boulders, rock, stones, lumber, masonry, debris, or organic material. Backfill shall be compacted to a minimum of density equal to the adjacent area as, determined by the standard proctor density procedure ASTM D-698. The remaining backfilling of the trench shall be carried up to limits directed by by the owner with suitable allowance for shrinkage.

Backfilling in areas beneath streets or other paved areas shall be accomplished with bank-run gravel and thoroughly compacted in layers not to exceed 8" in depth for the full depth of the trench. Backfill shall be compacted to a minimum of 95% maximum density at optimum moisture content, as determined by the Modified Proctor Test, ASTM D-1557. Subcontractor shall maintain all such areas in a condition satisfactory to the city until permanent repairs are made.

If there is not sufficient excavated material suitable to meet the requirements for backfilling material, the Subcontractor shall make up the deficiency by transporting suitable surplus material from excavations on other parts of the Work to complete the backfill. If still deficient then material shall be hauled from offsite by the Subcontractor.

All material hauled on site for fill or backfill shall be loose dry earth, sand, gravel or bank-run gravel. A minimum of 6 inches of topsoil shall be used to cover all backfilled and filled areas.

Wherever gas mains, water mains, sewers, etc. cross the sewer trench, 3000 psi design strength concrete shall be used for backfill beneath them. This backfill shall extend from the bottom of the trench up to spring line of the pipe crossing the trench. A rough wooden form shall be used to hold the concrete in place. The thickness of the backfill shall be 6 inches greater than the diameter of the crossing pipe. Concrete so required shall be considered as incidental to the Work.

705 DISPOSAL OF UNSUITABLE MATERIAL

Excavated material shall be used in backfilling around sewers and other structures unless determined by the Owner to be unsuitable. Unsuitable material will be disposed of by the Owner.

706 ROADWAY REPAIR

This work shall include the replacement of all roadway surface damaged or removed due to the construction of the sewers and appurtenant structures. All such work shall be done in accordance with the specifications of the City of St. Louis Park. No permanent road surface repair shall be made until the backfill in the trench and around manholes has settled and the city has given their approval to make such repairs. The maintenance of temporary road surfaces during the peirod of settlement is specified hereinbefore under 704 BACKFILLING. All repairs shall be same type and at least equal to existing pavements. Edges of existing pavement parallel to trench shall be cut to a neat line prior to making a repair.

All the work necessary to make repairs to road surfaces will be included in the bid for sewer construction.

707 WATER TESTS OF DISCHARGE AND DRAIN PIPES

See Mechanical Work Section 202 System Testing

708 PIPING MATERIALS

See Mechanical Work Sections 207 Discharge Water Piping and 208 Drain Piping

APPENDIX D

CONTINGENCY PLAN

CONTINGENCY PLAN

This Contingency Plan outlines the course of action to be taken if contaminated drilling fluids, cuttings, debris or water are encountered during the activities described in the Site Management Plan. For the purpose of this Contingency Plan, contaminated materials are defined as follows:

Solids containing creosote or coal tar constituents will be classified as contaminated if the creosote or coal tar constituents exceed half of the solid mass.

Groundwater or drilling fluids will be classified as contaminated if the water exhibits a discernible oil phase or sheen.

In the event that contaminated soils are encountered during excavation for foundations or underground piping, they will be handled as described in the Site Management Plan. In the event that contaminated water is generated during excavation work, it will be handled as described in this Contingency Plan.

Handling of Contaminated Solids

For activities whose duration exceeds one workday, contaminated solid materials will be placed in an isolated location at the work site immediately upon exposure or generation. The location will be secured by eight-foot, chain-link fence with locked gates. Silt fencing will be placed inside the fence to control the migration of contaminated material from the area. The ground surface within the isolation area

will be covered with an appropriate impervious barrier capable of withstanding the deleterious chemical properties of creosote or coal tar materials. Appropriate storage vessels will be provided within the secured area and utilized for containerization of contaminated materials as appropriate to meet the intent of this Contingency Plan. Materials not considered applicable for containerization on the site will be stockpiled on the impervious barrier for subsequent loading onto transport vehicles. Stockpiled materials will be covered with an impervious barrier at all times, unless work is underway which affects (i.e., adding to or removing from) the stockpile.

For activities whose duration is one workday or less, contaminated materials will be removed from the work site before workday's end, if possible. If contaminated material cannot be removed by workday's end, the material will be placed in a secured area at the site as described above.

The handling of contaminated solid material, including its loading into appropriate storage vessels or placement in an isolated location on site, and its release to a transporter licensed to haul said wastes will be in accordance with the provisions of applicable regulations. Contaminated solid materials scheduled for off-site disposal will be transported to a RCRA hazardous waste TSD facility in accordance with the provisions of applicable regulations.

In the event the activity contemplated within the Site Management Plan is addressed in Section 11.5 of the RAP, contaminated soil that has been excavated will be replaced in approximately its original location and covered by clean soil to a depth of at least 12 inches.

In the event the activity contemplated within the Site Management Plan generates relatively small amounts of contaminated solid material, the contaminated material may be replaced in approximately its original

location, in which case it will be covered by clean soil to a depth of at least 12 inches. The determining factor in deciding whether contaminated materials may be returned to their original location will be the likely effects of such action on accomplishing the technical objectives of the RAP.

Handling of Contaminated Liquids

In the event that contaminated liquids are encountered or generated during the conduct of the work described in the Site Management Plan, the liquids will be pumped to the sanitary sewer if they contain less than ten percent organic material. Estimates of flow rate and disposal volume will be established and the Metropolitan Waste Control Commission (MWCC) will be informed before the discharge to the sewer if the estimated flow exceeds 150 gallons per minute per workday. Contaminated liquids containing more than ten percent organic material will be handled as solid material under the terms of this Contingency Plan.

Any drilling equipment with visible contamination will be steam cleaned upon completion of well construction or reconstruction work. The resulting rinsate will be handled in accordance with the provisions of this Contingency Plan.

Handling of Noncontaminated Materials

Solid material which is not contaminated -- as defined in this Contingency Plan -- yet appears to contain creosote or coal tar constituents will be retained at the work site. The material will be replaced in approximately its original location, or if not all affected material can be so placed, a second excavation will be completed at the work site for burying the material. In either case, the affected material will be covered with at least 12 inches of clean soil.

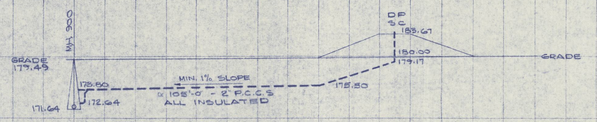
Unaffected excavated material taken from the second excavation will be removed from the site and affected material will be returned in its place.

Uncontaminated water (no discernible oil phase or sheen) resulting from the activities described in the Site Management Plan will be disposed of in the storm sewer or by any other means acceptable to the City of St. Louis Park.

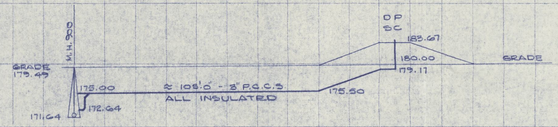
Communications

The Reilly Project Leader or Alternate Project Leader will inform the EPA, MPCA and City of St. Louis Park Project Leaders or Alternates of the status of actions taken pursuant to this Contingency Plan. Such notification may be oral or written, as agreed by the Project Leaders.

All actions, decisions and communications by the Reilly, City, EPA and MPCA Project Leaders in implementing this Contingency Plan will be in accordance with and are subject to the provisions of Parts I, J and O of the Consent Decree.

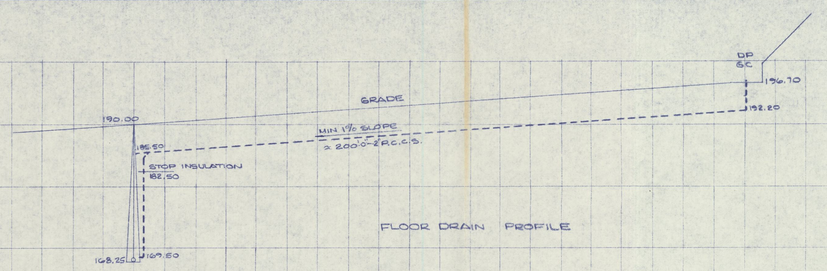


FLOOR DRAIN PROFILE

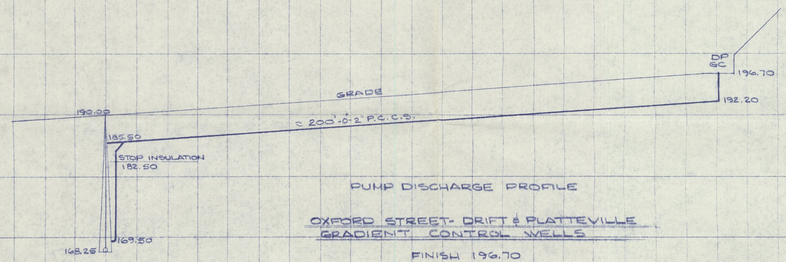


PUMP DISCHARGE PROFILE

LAKE STREET - DRIFT & PLATTEVILLE
SOURCE CONTROL WELLS
EXIST. 180.00
FINISH 183.67

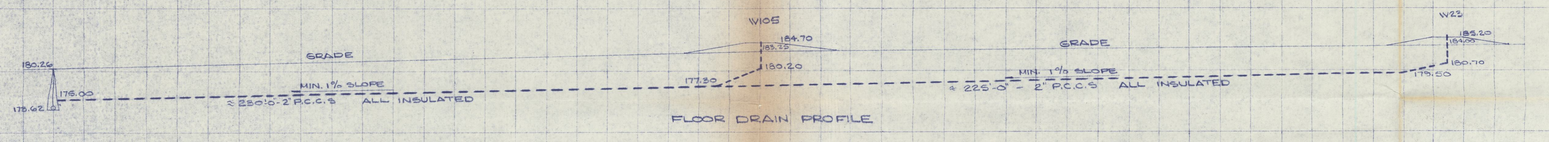


FLOOR DRAIN PROFILE

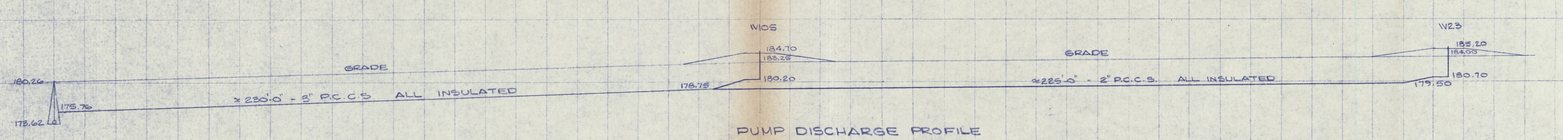


PUMP DISCHARGE PROFILE

OXFORD STREET - DRIFT & PLATTEVILLE
GRADIENT CONTROL WELLS
FINISH 196.70



FLOOR DRAIN PROFILE



PUMP DISCHARGE PROFILE

LOUISIANA AVE. W105 & W23
SOURCE CONTROL WELLS

W105	W23
Ex. 183.26	Ex. 184.00
FIN. 184.70	FIN. 185.20

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Louis D. Locke, Jr.

Date 1/23/87 Reg. No. 017585

NOTE:
ALL PIPE ELEVATIONS ARE THE INVERT ELEVATION
---- REPRESENTS FLOOR DRAIN LINES
——— REPRESENTS PUMP DISCHARGE LINES

JAN 26 1987

PHOTOSTAT	DATE:
MICRO FILM	DATE:

REVISIONS

NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D

REVISIONS

NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D

REVISIONS

NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D

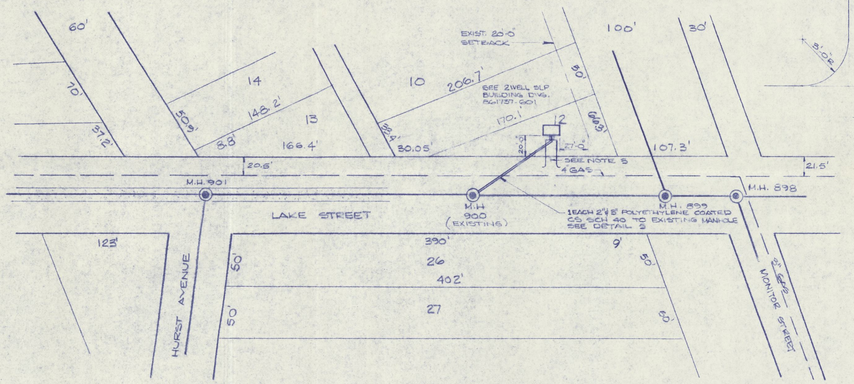
REFERENCE DRAWINGS

DRAWING NUMBER	DESCRIPTION

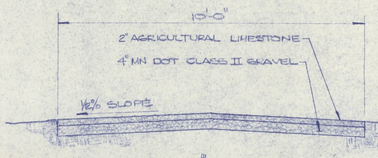
REILLY TAR & CHEMICAL CORPORATION
INDIANAPOLIS INDIANA

UNDERGROUND PIPING PROFILES

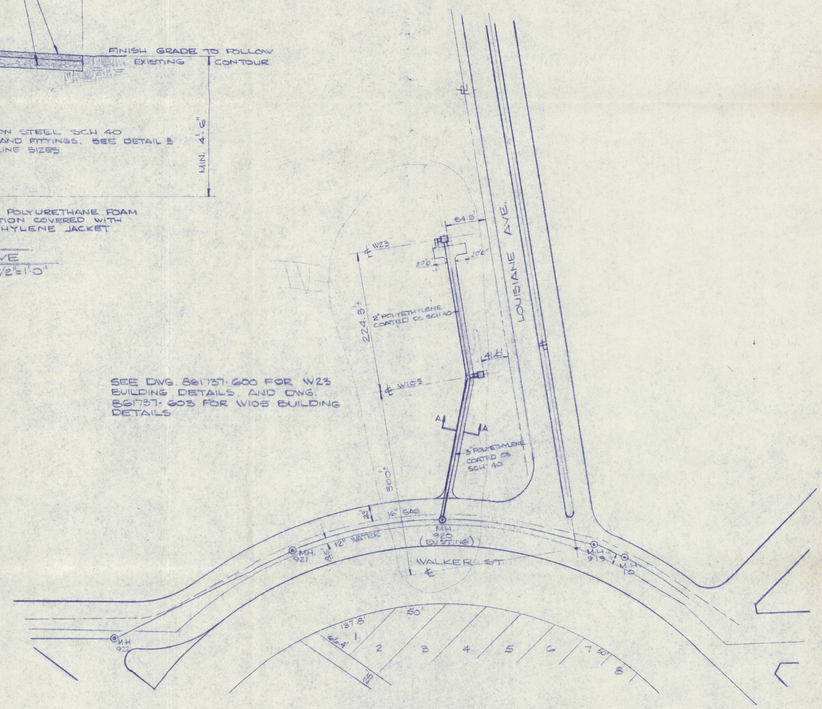
DRAWN BY	DATE	CHECKED BY	DATE	PLANT	REVISION
AK	11/22/87		1/29/87	St. Louis Park, Minn.	
SCALE HORIZONTAL: 1" = 20' VERTICAL: 1" = 10'		APPROVED BY	DATE 1/23/87	DRAWING NUMBER 861737 - 300	



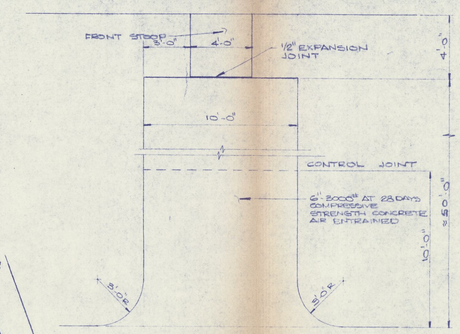
DETAIL 1
LAKE STREET 2 WELL SLP BLDG
SCALE: 1" = 60'
SEE ELEVATIONS ON DWG. 861737-800



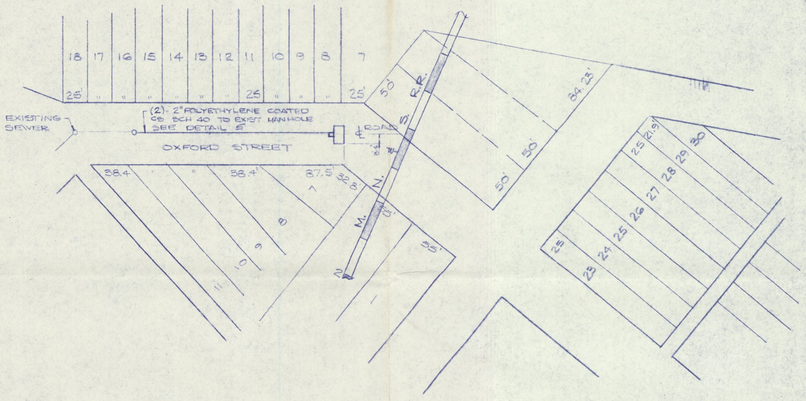
SEC. A-A
GRAVEL DRIVE
SCALE: 1/2"=1'0"



DETAIL 3
LOUISIANA AVE. 1 WELL SLP BLDG'S.
(2 REQ'D)
SCALE: 1"=100'
SEE ELEVATIONS ON DWG. 861737-300

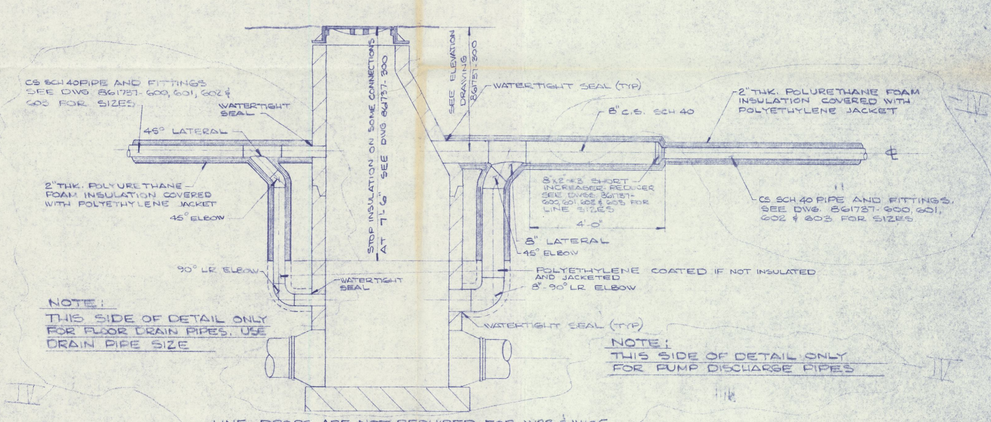


DETAIL "A"
CONCRETE DRIVE
SCALE: 1/4"=1'0"



SEE DWG. 861737-602 FOR BUILDING DETAILS

DETAIL 2
OXFORD ST. 1 WELL SLP BLDG
SCALE: 1" = 60'
SEE ELEVATION ON DWG. 861737-800



NOTE:
THIS SIDE OF DETAIL ONLY FOR FLOOR DRAIN PIPES, USE DRAIN PIPE SIZE

NOTE:
THIS SIDE OF DETAIL ONLY FOR PUMP DISCHARGE PIPES

LINE DROPS ARE NOT REQUIRED FOR W23 & W105

DETAIL 5
TYPICAL CONNECTION TO EXISTING MANHOLE FOR DISCHARGE PIPES AND FLOOR DRAINS
NO SCALE
SEE DWG. 861737-300 FOR ELEVATIONS

NOTES:

3 EXTEND DRIVE TO STREET

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

LEWIS D. LOCKE JR. CIVIL ENGINEER 017565 REGISTERED

Date July 22, 1986 Reg. No. 017565

JAN 26 1987

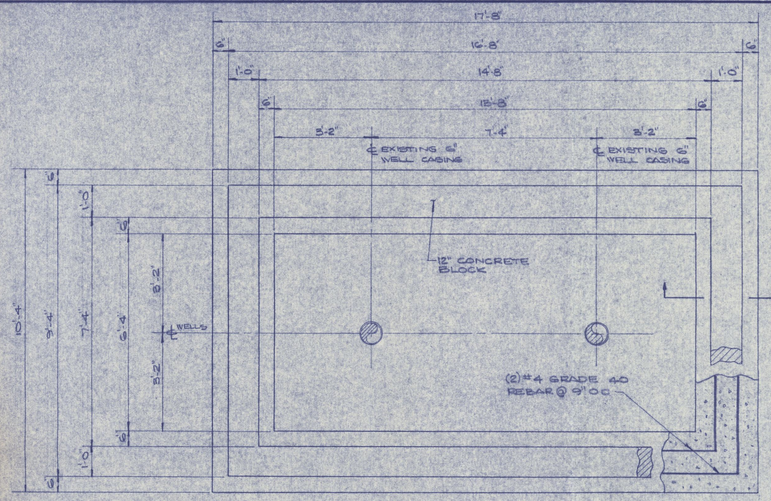
PHOTOSTAT	DATE:
MICRO FILM	DATE:

REVISIONS						REVISIONS						REVISIONS						REFERENCE DRAWINGS	
NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D	NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D	NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D	DRAWING NUMBER	DESCRIPTION
												IV	1/20/87	AK	REMOVED DETAIL 4 AND NOTES 1 & 2, CONNECTED SEWER LINES FROM W23 & W105 TO M.H. 920 AND ADDED NOTES. MARKED		
												III	10/28/86	AK	REVISED INLET LINE SIZE AND ARRANGEMENT TO ELECTRIC MANHOLE		
												II	10/16/86	AK	CHANGED ORIENTATION OF WELL HOUSES, CHANGED NOTES, ADDED NOTES #5 AND DETAILS A, & 4 SEE A-A, MANHOLE DRAIN		
												I	7/7/86	AK	ADDED DETAIL 4 & CALLED OUT NEW LINES & M.H.'S		

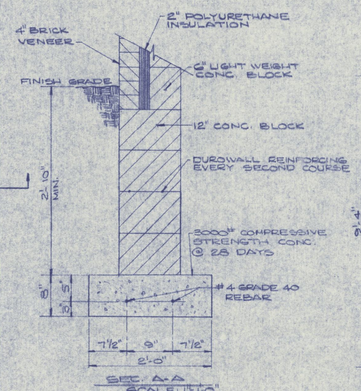
REILLY TAR & CHEMICAL CORPORATION
INDIANAPOLIS INDIANA

ST. LOUIS PARK WELL LOCATIONS

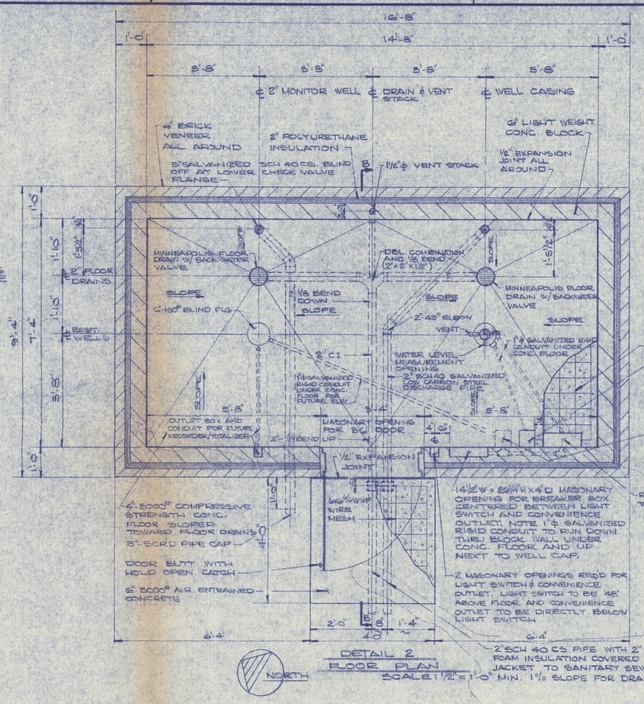
DRAWN BY	DATE	CHECKED BY	DATE	PLANT	REVISION
AK	6/27/86			ST. LOUIS PARK, MINN.	IV
SCALE		APPROVED BY	DATE	DRAWING NUMBER	
INDICATED			4/09/86	861737-901	



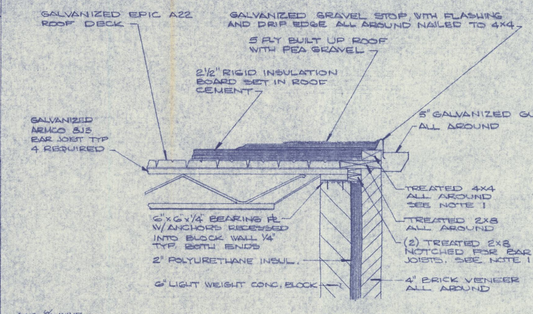
DETAIL 1
FOUNDATION PLAN
SCALE: 1/2"=1'-0"



SEC. A-A
SCALE: 1"=1'-0"



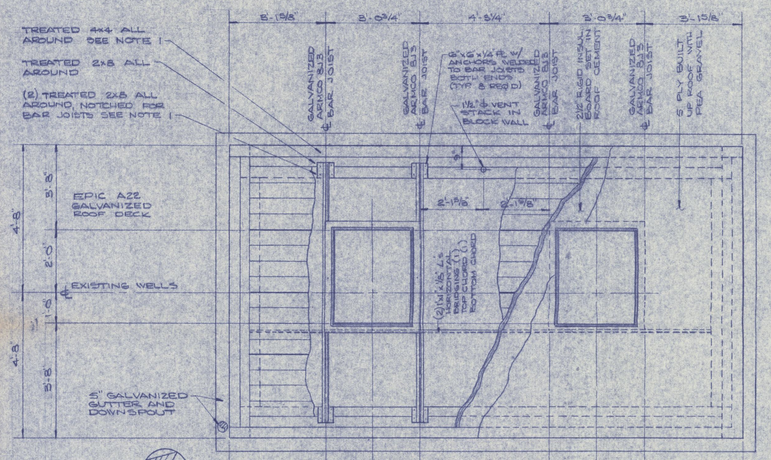
DETAIL 2
FLOOR PLAN
SCALE: 1 1/2" = 1'-0" MIN. 1% SLOPE FOR DRAIN LINE.



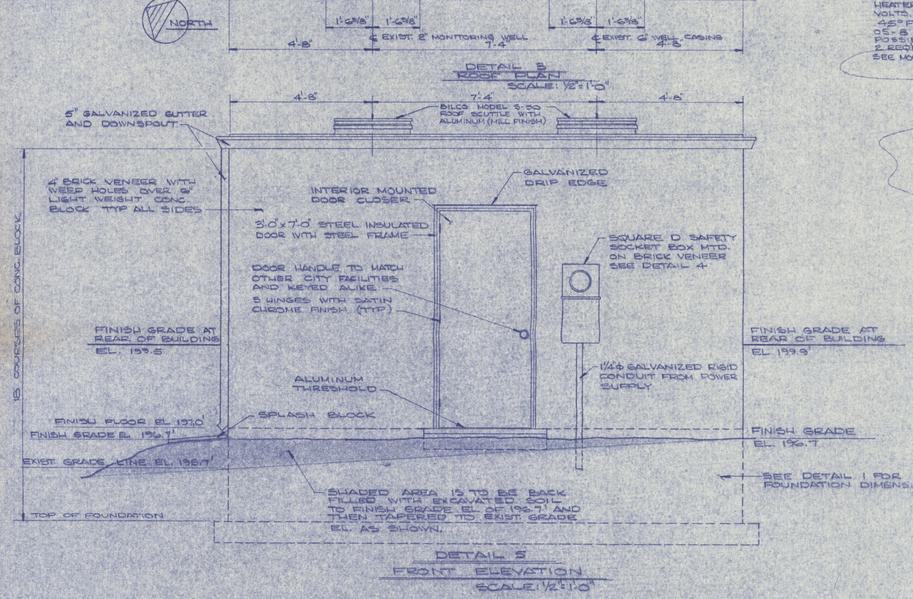
SEC. C-C
ROOF SECTION
SCALE: 1"=1'-0"

WELL COMPONENT SCHEDULE

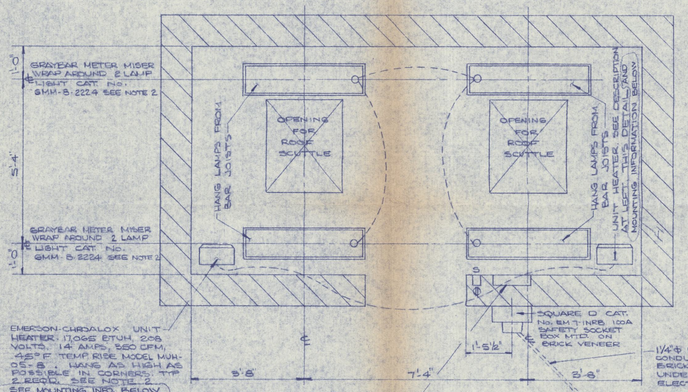
WELL	(1) DISCHARGE SIZE	(2) POWELL GATE VLV. FIG./SIZE	(3) WATER FLOW CONTROLER / SIZE	(4) HERSEY TURBINE METER W/ TOTALIZER SIZE	(4) TRU MISSION DUO CHECK II / SIZE	(5) REDUCED PRESS. BACKFLOW PREVENTER
D-P GC	2"	615 / 2" FLGD.	5 FA1-1 / 2" FLGD.	HVK-160-C-1-1-8200-T-8-N / 2" NPT	K 15 HMF / 2"	825Y / 2" NPT



DETAIL 3
ROOF PLAN
SCALE: 1/2"=1'-0"



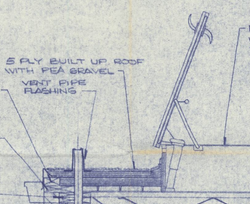
DETAIL 5
FRONT ELEVATION
SCALE: 1/2"=1'-0"



DETAIL 4
ELECTRICAL PLAN
SCALE: 1/2"=1'-0"

NOTES:

1. TREATED 4x4 MUST BE CUT DOWN FOR A TOTAL THICKNESS OF 2 1/2" TO MATCH INSULATION THICKNESS.
   (2) TREATED 2x8 MUST BE CUT DOWN FOR A TOTAL THICKNESS OF 2 1/2" TO MATCH BAR JOIST BEARING END THICKNESS.
2. 3/4" RIGID CONDUIT IN WALL TO BOXES ABOVE EACH LIGHT AND BOXES BEHIND HEATERS, THEN FLEX CONDUIT TO LIGHTS AND HEATERS.
3. THE HERSEY FLOWMETER WILL HAVE AN E-SS ELECTRONIC PULSE OUTPUT DEVISE THAT WILL SIGNAL A MODEL 1005 PULSE TO D.C. CONVERTER WHICH WILL SEND OUTPUT TO THE CHESSELL 530 RECORDER / TOTALIZER.



DETAIL D
VENT AND WATER MEASUREMENT OPENING DETAIL
SCALE: 1 1/2" = 1'-0"

DETAIL G
SEC B-B
SCALE: 3/4"=1'-0"

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

LEWIS D. LOCKE JR. CIVIL ENGINEER 013565 REGISTERED PROFESSIONAL ENGINEER STATE OF MINNESOTA

Lewis D Locke Jr.

Date 10/20/86 Reg. No. 013565 0

JAN 26 1987

PHOTOSTAT	DATE:
MICRO FILM	DATE:

REVISIONS

NO.	DATE	BY	DESCRIPTION	CHK'D	APP'D
1	12/8/87	AK	ADDED RECORDER/TOTALIZER AND CONDUIT ALSO BACKFLOW PREVENTER AND NOTE 3. CHANGED UNIT HEATERS AND REDUCED HEAD BOARD W/ RIGID PIPE		

REFERENCE DRAWINGS

DRAWING NUMBER	DESCRIPTION

REILLY TAR & CHEMICAL CORPORATION
INDIANAPOLIS INDIANA

DRIFT-PLATTEVILLE GRADIENT CONTROL WELL BUILDING

DRAWN BY	DATE	CHECKED BY	DATE	PLANT	REVISION
AK	10/9/86		10/20/86	St. LOUIS PARK, MINN	1
SCALE: INDICATED		APPROVED BY	DATE 10/20/86	DRAWING NUMBER S-81781-602	